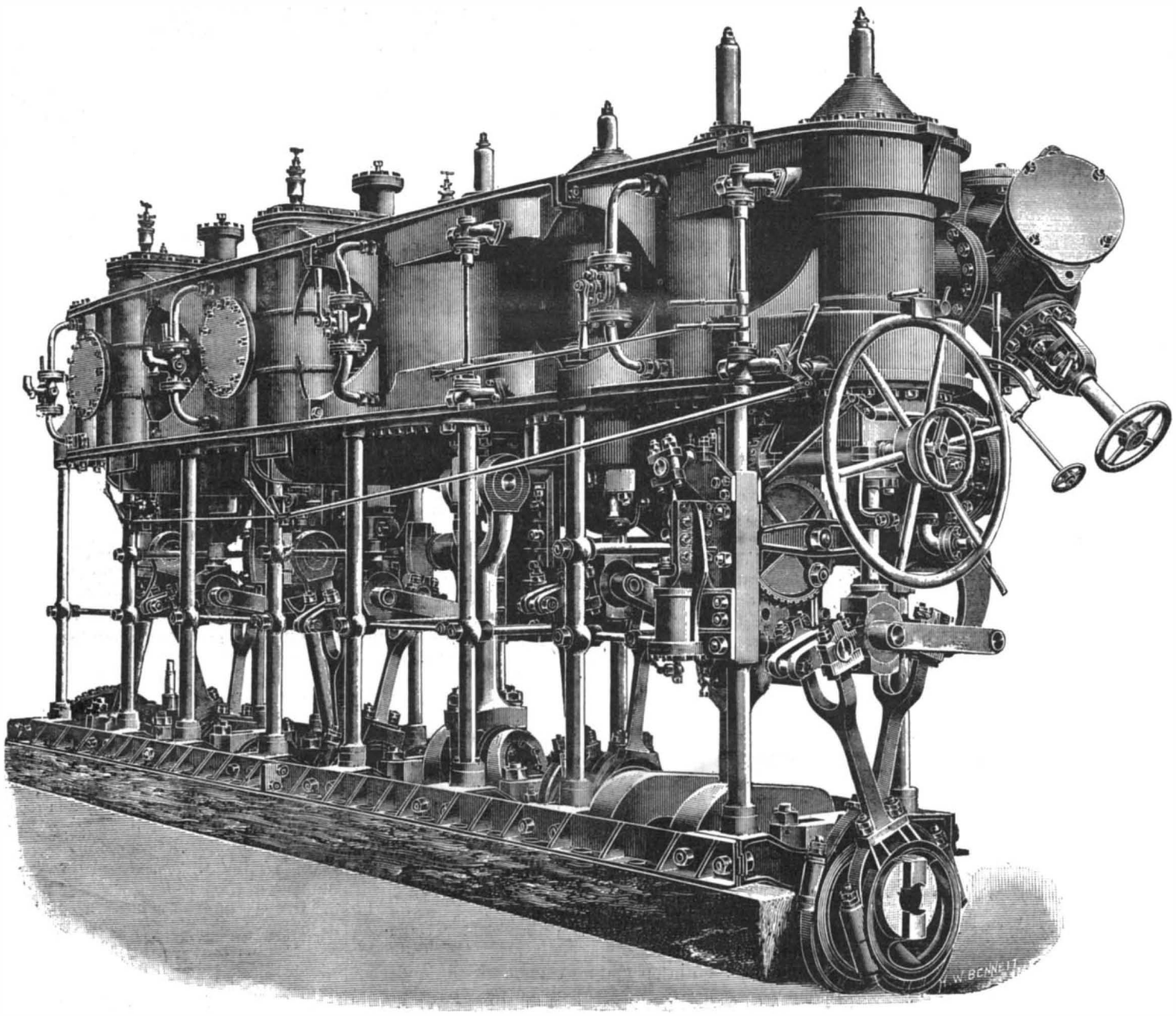
SCIENTIFIC AMERICAN

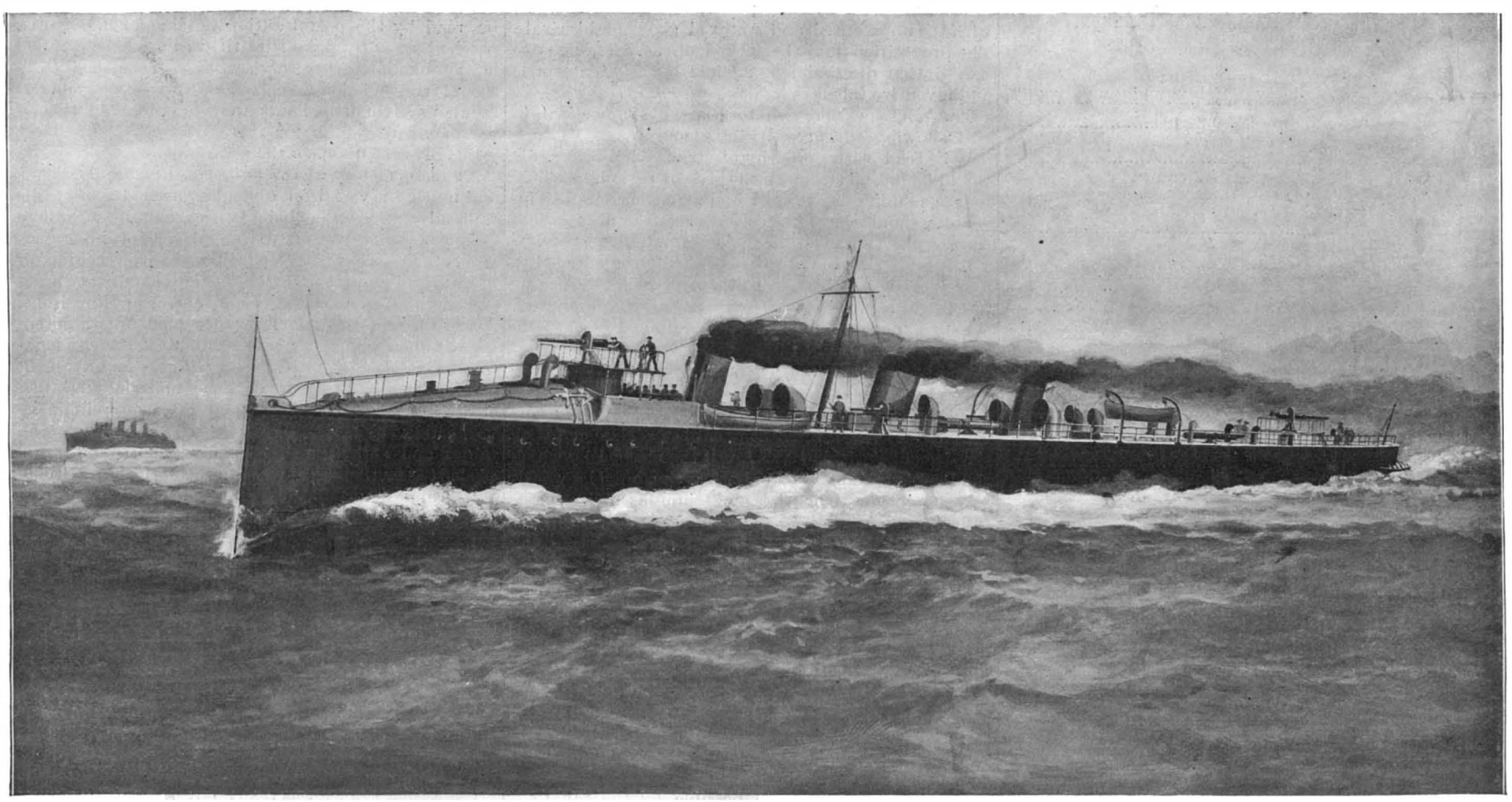
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1898, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS CHEMISTRY, AND MANUFACTURES.

Vol. LXXVIII.—No. 25. ESTABLISHED 1845. | NEW YORK, JUNE 18, 1898. | $3.00 A YEAR. WEEKLY.

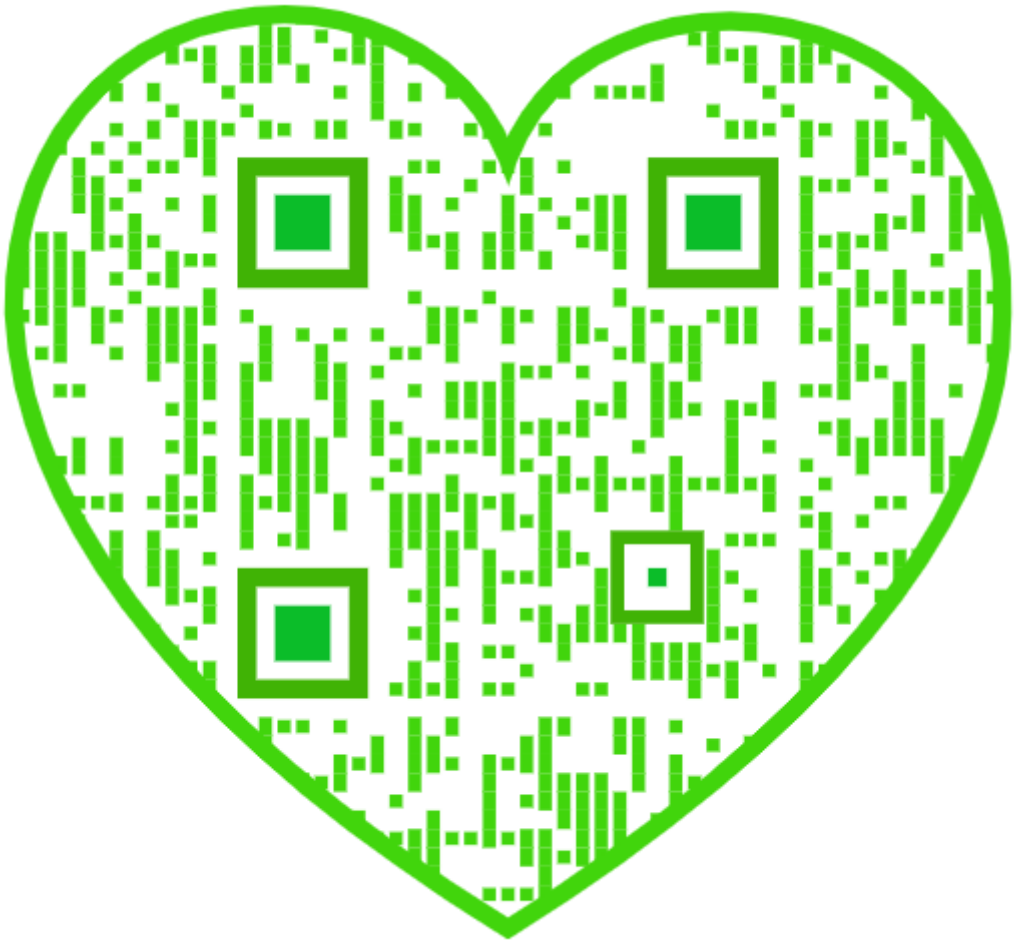


ENGINES OF THE SPANISH TORPEDO-BOAT DESTROYER "TERROR."



SPANISH TORPEDO-BOAT DESTROYER 'TERROR.—[See page 391.]

© 1898 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.
(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....$3.00
One copy, six months, for the U. S., Canada or Mexico..... 1.50
One copy, one year, to any foreign country, postage prepaid, £0 15s. 5d. 4.00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

The Scientific American Supplement
(Established 1876)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year for the U. S., Canada or Mexico. $6.00 a year, or £1 4s. 8d., to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries, *eight dollars and fifty cents a year*, or £1 14s. 11d., postage prepaid.

Building Edition of Scientific American.
(Established 1885.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders, and all who contemplate building this work is invaluable.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign countries, $3.00 a year, or £0 12s. 4d. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign countries, $6.50 a year, or £1 6s. 9d. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN, and SUPPLEMENT, $9.00 a year. To foreign countries, $11.00 a year, or £2 5s. 2d., postage prepaid.

Export Edition of the Scientific American
(Established 1878)

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN, published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 100 pages, profusely illustrated. It is the finest scientific industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, or £0 12s. 4d., postpaid to any part of the world. Single copies, 25 cents.

MUNN & CO., Publishers, 361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, JUNE 18, 1898.

Contents.

(Illustrated articles are marked with an asterisk.)

Air, analysis by mushroom..... 387
Antiseptic substances, test of... 388
Automobile carriage*..... 389
Books, new..... 396
Carbide protecting..... 394
Communications during siege of Paris..... 386
Criticism, friendly..... 388
Dentistry, prehistoric..... 391
Engine, rotary*..... 389
Flames, singing..... 387
Flooring, Cantwell's*..... 388
Gas meter..... 389
Horse cavalry*..... 392
Inventions recently patented.... 396
Journeys, quick..... 390
Manila, departure of troops for.. 387
Miscellaneous notes and receipts 390
Niagara power house*..... 393
Odors, dangerous..... 388
Paris, siege of..... 386
Patents, list of..... 397
Philippines, volcanoes and earthquakes*..... 395
Plants, fever in..... 394
Power house at Niagara*..... 393
Santiago de Cuba*..... 392
Science notes..... 390
Shipbuilding, German, in 1897... 390
Slaughter house in relation to disease..... 394
SUPPLEMENT, current..... 391
"Terror" torpedo boat destroyer*..... 385, 391
Theater sickness..... 391
Trademarks and patents..... 386
Valve for tower, Urmson's..... 388
War revenue bills..... 386
Wheel, McDowell's*..... 388
Wool driers, Spencer's*..... 388

TABLE OF CONTENTS OF

Scientific American Supplement

No. 1172.

For the Week Ending June 18, 1898.

Price 10 cents. For sale by all newsdealers.

PAGE

I. BOTANY AND HORTICULTURE.—Some Interesting Plants.—3 illustrations..... 18760
Strawberry Leaf Spot.—1 illustration..... 18761

II. ECONOMICS.—Great Britain's Mineral Wealth..... 18759

III. ELECTRICITY.—The Development of the Central Station.—By SAMUEL INSULL..... 18762

IV. HYDRAULIC ENGINEERING.—Southwark and Vauxhall Water Company's Pumping Station at Streatham.—1 illustration. 18753

V. ILLUMINATION.—Apparatus for the Production of Acetylene Gas.—6 illustrations..... 18751

VI. MISCELLANEOUS:
Engineering Notes..... 18754
Electrical Notes..... 18754
Selected Formulæ..... 18754

VII. NATURAL HISTORY.—Pests and Poisonous Creatures Peculiar to Cuba and the Philippines.—By Dr. G. ARCHIE STOCKWELL..... 18761

VIII. ORDNANCE.—Machine for Making Cartridges.—2 illustrations 18759
Vickers' Guns.—4 illustrations..... 18749

IX. PATENTS.—Patents.—By JAMES W. SEE..... 18755

X. PHOTOGRAPHY.—Three-Color Photographic Printing.—By Capt. W. DE W. ABNEY..... 18750

XI. WARFARE.—New Camp Equipments for the German Army.—10 illustrations..... 18756
The Battle of Manila.—2 illustrations..... 18757

CONTENTS
Of the June Number of the
SCIENTIFIC AMERICAN, BUILDING EDITION.

(Illustrated articles are marked with an asterisk.)

Albany capitol, the completion of..... 107
Chapel, New Utrecht Reformed, at New Utrecht, L. I.*....102, 105
Cottage at New Haven, Conn.*94, 106
Dwelling, model, at Hackensack, N. J.*....100, 105
Dwelling, model, at New Haven, Conn.*....101, 106
Father of village improvement societies..... 93
Heights of chambers in mediæval houses..... 106
How to heat a village house..... 106
Losses in fireproof buildings.... 107
Lost art, a..... 106
Novel features in office buildings 92
Paris Bazar de la Charite..... 107
Planting of private grounds..... 92
Public weighing house of Bremen*....91, 92
Residence at New Haven, Conn.*....96, 106
Residence at Bensonhurst, L. I.*....95, 105
Residence at Bridgeport, Conn.*....103, 105
Residence at Brookline, Mass.*....97, 105
Signing of buildings..... 92
Special Navy Supplement..... 107
Stone residence and stable at Yonkers, N. Y.*....93, 98, 99
Steel ceilings and wainscoting... 106
Trimmer, the Fox Universal*.... 107
Vanderbilt houses, the, New York City, N. Y.*....104, 105
Wax polish for hardwood floors* 107

Subscription, $2.50 a year. Single copies, 25 cents.

TRADEMARKS AND PATENTS AND THE WAR REVENUE BILL.

As we are going to press, the War Revenue Bill is reported to have been favorably acted upon by the conferees, and it is probable that the bill will be passed and be put in the hands of the President by the time the present issue is published. It is with a great deal of pleasure that we have to announce that the so-called Chilton amendment, which has caused so much consternation among manufacturers, has been eliminated from the bill. This bill was originally passed by the Senate, and, in justice to that body, it must be said that we believe such a bill would not have been passed under ordinary circumstances; but those who considered the bill unwise and radical in its nature were unable to offer such opposition to its passage as they deemed necessary, owing to the urgent nature of the bill as a whole. The object of the bill was to place a graduated tax on all articles sold in boxes or other parcels, which had been prepared or manufactured under letters patent, or which were sold under trademarks.

In the first place, the joinder of patents and trademarks had nothing in reason to justify it. They have nothing whatever in common. The amendment was evidently based on the supposition that both inventors and owners of trademarks depend for their property rights on the national government. This is in no sense true of the owners of trademarks, and if inventors receive rights it is simply as an inducement to disclose a knowledge of their inventions to the public.

As to trademarks, it would seem that their very nature and purpose had been lost sight of. A merchant or manufacturer adopts a mark solely that his goods may be identified by the purchaser, and it is a guarantee of good faith. If the goods turn out to be of indifferent quality, the purchaser can thus avoid buying again. To tax them, therefore, would only invite omission of the use of the trademark, and this would mean simply the suppression of any guarantee or any means by which the purchaser could guard against a second deception, and would give the advantage to the dishonest and unskilled merchant or manufacturer, who puts out goods without a mark of identification, to the detriment of the public. Reputable manufacturers and merchants would, therefore, have been compelled to use their marks only to such a nominal extent as would preserve their property rights.

Trademarks do not depend on statutory enactment. They primarily are protected by common law. Indeed, only trademarks in use in foreign trade or trade with Indian tribes are registerable. So sacred have trademarks been held from medieval times, that even the marks of foreigners have been upheld in the leading countries of the world (often without registration), even when a state of war existed with the country of which the foreigner was a subject.

Clearly a tax should be impartially fixed on the goods of a certain character or description, and not on the mere trademark, which simply stands for the good name of the reputable merchant, otherwise the man having no reputation and no trademark can undersell him who honestly and fearlessly puts on his personal mark guaranteeing his goods.

A tax on patented goods also would be prohibitive in most cases, because the patentee could not compete with the unpatented and untaxed goods of his rivals. The proposition must be looked on as a strange one indeed that discriminates against honesty, enterprise and inventive talent.

The great speech of Senator Platt, of Connecticut, in 1884, showing the necessity of encouraging inventors, may be read with profit by his fellow legislators. It would be indeed strange if the present period, in which we are reaping the reward of having encouraged inventors, should have been selected as the appropriate time to place a fine on the maker of patented goods.

It is gratifying to note that the conferees were led to perceive the mischievous consequences of the bill before it was returned to either House for consideration. We have to congratulate ourselves upon the very sensible stand which has been taken in regard to what would have been a most harmful measure.

COMMUNICATIONS DURING THE SIEGE OF PARIS.

Among the most interesting subjects connected with the siege of Paris, in 1870–71, was the method by which the Parisians communicated with the outside world, and the story of their trials and triumphs never ceases to be interesting. Even after the war had begun, the Parisians delighted to demonstrate to each other the mathematical impossibility of the investment of the city; but in a few short weeks they were shown their error, and they were surrounded by an impenetrable line of German soldiers. Paris was well fortified, armed, garrisoned and provisioned, but they now had to solve the problem of communications from outside.

There were within the fortifications about 2,000,000 people, a quarter of whom were under arms, and it was remarkable that the beleaguered capital should have succeeded in obtaining almost constant communications with the departments during the siege—a circumstance which was only rendered possible by the rapid advance made in the few preceding years in science. The stubborn resistance which Paris offered to the enemy was due to a considerable extent to the facility with which they communicated with the outside world, for the mental anxiety consequent upon the complete isolation of hundreds of thousands of human beings unfits them for resolutely engaging in a struggle of lengthened duration.

On September 18, 1870, the last regular dispatch of letters from Paris was sent, and at 5 o'clock P. M. the early mail train was forced to return; but on the 20th, the post office authorities attempted to send out the mails in three light-colored vehicles, drawn by three horses and accompanied by horse and foot couriers; but, with the exception of one of the latter, they were all driven back by the bullets of the German sentries. Up to the 24th of September, a number of couriers were sent out, but only a few succeeded in passing the German lines. The majority of these messengers carried with them dispatches in cipher, which were carefully secreted. At last the plan of sending out these men was abandoned. Paris, at this period, was far from depending exclusively upon the postal couriers. After the time when the land route became practically closed, and water communications being impossible, recourse to the air was taken.

Naturally the idea of employing balloons to take out letters early suggested itself to every one. On September 21, the director of the Paris post office gave notice to the public to write their letters on extremely thin paper and to dispense with the envelope, and it soon transpired he had made arrangements with Nadar, the well-known aeronaut and photographer, to establish a regular balloon service.

On September 23, the "Neptune," in charge of M. Duruof a well-known aeronaut, ascended with three mail bags containing 25,000 letters. The Prussians pointed cannon at the balloon, but the balls exhausted their impetus before the balloon was reached, though some of them arose sufficiently high to cause the balloon to vibrate perceptibly. The infantry peppered away with their rifles, but did no damage, and the aeronaut amused himself by showering down a quantity of Nadar's address cards upon the heads of the Prussians. In three-quarters of an hour he alighted near Evreux, and his mail and official dispatches were promptly delivered. The departure of the next balloon, the Città di Firenze, took place on September 25, carrying 104 kilogrammes of letters, and with great difficulty the balloon succeeded in making a successful voyage. From that day the transit of Paris mails through the air was an accomplished fact and by degrees the weight of all letters was limited to one-eighth of an ounce.

Energetic steps were at once taken to construct a number of balloons for postal purposes. All of the balloons in the city were utilized first. An aeronautic company was formed for the manufacture of the balloons. The cost of each was to be $800, including the cost of gas for its inflation. The aeronaut was to receive $40 for each ascension. A number of small paper balloons 18 feet in diameter were also constructed which would be capable of raising rather more than a hundredweight. These "free balloons," as they were styled, were abandoned to the mercy of the winds without any aeronaut, and they only carried newly authorized postal cards, the contents of which were to be read by the postal authorities before being dispatched, so as to make sure they contained no information likely to prove serviceable to the enemy. The cost of transmission was fixed at two cents each. A regular system of lookouts were organized in the departments to watch for these free balloons. They were only sent up when the wind was favorable.

A balloon factory was organized at the Gare d'Orleans and under the vast iron and glass arched roof of this railroad station the balloons were built. Sailors balanced themselves on the metal girders and trusses and suspended long strips of colored calico reaching almost to the ground, and from the girders already hung wickerwork cars, trailing ropes and grappling irons. A score of women were either occupied in straightening out and ironing long pieces of material or else soaking the calico to get rid of its stiffness and dyestuff. Having been hung up to dry, the material was then cut to the various patterns, and after a preliminary varnishing, a hundred or more girls seated at long tables and superintended by Madame Godard proceeded to sew the seams with mathematical exactitude. Then came a second coat of varnish both inside and out. The balloons were then inflated by means of a metal fan which caused the varnish to dry quicker and facilitated the detection of any holes that might hitherto have passed unperceived. The netting, ropes and other tackle, together with the cars, were all made by sailors. The balloons were 51 feet 8 inches in diameter, 162 feet 4 inches in circumference and had a capacity of 72,234 cubic feet. Each balloon required twelve days to manufacture. The total weight of the balloon, independent of passengers and cargo, was 2,200 pounds. The balloon itself weighed 450 pounds, and was tested after inflation and held captive until the test was completed at an altitude of 655 feet.

For a time France was really governed by balloons,

© 1898 SCIENTIFIC AMERICAN, INC.

and M. Gambetta was conveyed over the Prussian lines in a balloon. He had a most exciting trip. The first attempt of ascent was relinquished at an altitude of 600 yards, for some Prussian soldiers were perceived immediately underneath. Their arms were piled, and while they rushed to these, ballast was thrown out, but the balloon did not mount sufficiently fast to prevent several balls penetrating it, one of them grazing Gambetta's head. The ascent was safely made near Montdidier. Subsequent to Gambetta's departure from Paris, says Mr. Vizetelly, "the government decided on dispatching other ardent republicans through the clouds to arouse the provinces from their lethargy. Louis Blanc was asked to proceed to England to awaken the sympathies of the British nation in favor of France. Victor Hugo was also offered a commission to the departments, but both of these illustrious democrats declined, the former on the plea to a particular aversion to balloon traveling and the latter on the score that his mission was to consecrate himself exclusively to the defense of the capital."

Of all the balloons which left Paris at this time, by far the most successful voyage was that of the "Washington," which took out no fewer than 120,000 letters. Military balloons were also used in Paris for obtaining a view of the enemy. The Germans had Herr Krupp cast special cannon of extremely small caliber to destroy the balloons.

Carrier pigeons were also used to a considerable extent, and 1,100 trained birds were brought in before the siege and lodged at the Jardin des Plantes. Pigeons were dispatched with balloons to bring back word of the safe descent of the balloons, these pigeons being furnished by several carrier pigeon societies. Not infrequently the pigeons, when they returned, were found to be wounded either by some bird of prey or by shots from the German rifles. The Germans brought birds of prey to the environs of Paris in order that they might pursue the carrier pigeons. The dispatch was generally contained in a quill fastened to a tail feather that remained immovable when the pigeon spread its tail to fly. Very many of the messages were lost, however.

With an aerial fleet at their disposal, there had never been any difficulty in getting letters out of Paris in a reasonable time, but the means of obtaining news from the provinces were limited in the extreme, and at last the people had to fall back to the employment of pigeon messengers. Originally the latter were only employed to convey government dispatches to announce the safe arrival of some balloon in the provinces, but in the month of October it was also suggested that they might be used to convey the correspondence of the general public. At first the messages had to follow a fixed form, the words being limited to "no" and "yes," to questions such as "Are you well?" "Do you want money?" etc., which had been previously asked in letters sent out of Paris by balloon. The charge for conveying these messages was one franc. The messages were sent to the postal delegate at Clermont-Ferrand, where they were copied on a single sheet of paper and then reduced by photography to the most minute proportions and sent by pigeons into the capital. On the arrival of these dispatches, the characters were enlarged with a microscope and each message was copied onto a card and forwarded to the person to whom it was addressed. The plan was found to be rather inconvenient, and at last ordinary messages were allowed to be sent. A charge of half a franc was made for each word contained in the dispatch and the limit of the message was twenty words. The messages were set up in type and printed; they were then photographed, thus rendering them a great deal more legible. When reduced, they occupied a piece of paper 1½ by 1¼ inches, having the appearance of a diminutive journal of four columns. One message followed the other without interval of any kind. The reverse side was also filled with messages. Three of the first birds sent off carried nearly a thousand dispatches by means of this arrangement. Post office orders to the value of 300 francs each could be forwarded in a similar manner, and photographic reproductions of the "Tours Moniteur" and "The London Times" were sent into the capital. The films used were of collodion. A suitable number of copies were made of each sheet. They were then rolled and inclosed in a small quill, which was sewed on the tail feathers of as many pigeons as could be procured. The employment of thin films of collodion instead of paper was a great improvement, for these films were ten times thinner and lighter than paper, so that a pigeon was able to carry an increased budget of news with a diminution of both weight and volume.

On the arrival of the pigeons in Paris, the quills containing the microphotographic dispatches were split open with a penknife and the films were rapidly unrolled in water containing a few drops of ammonia. The films were then dried and inclosed within two plates of glass. They were then ready to be deciphered by the microscope. This mode of reading proving slow, recourse was had to the projecting lantern, using the electric light. The thin film of collodion containing the message was placed in the proper part of the apparatus and the message was thrown on a large screen, so that four transcribers could work at once on different parts of the dispatch sheet, each square of which contained some 1,600 messages. At a later time the dispatches were photographed on collodion films on the scale of the original printed matter, so that each section was enlarged from the most minute dimensions to the size of an 18mo page; the characters, being in good, bold type, could thus be read off with perfect ease. The collodion film was, moreover, raised from the glass and transferred to a sheet of black oiled cloth dressed with gum arabic. Finally, the telegrams were separated from each other by means of scissors, and each person received his dispatch in facsimile of the original printed matter. This system proved to be very satisfactory, and when the pigeons escaped the hawks and guns, the Parisians were tolerably sure of obtaining information from their friends. Many of the dispatches have been transferred and are now exhibited as specimens of microphotography, thus affording a unique microscope object. Other means that were tried was to tie messages onto dogs and have them penetrate the German lines, but the scheme was not found to be satisfactory.

DEPARTURE OF TROOPS FOR MANILA.

BY OUR CALIFORNIA CORRESPONDENT.

The Presidio, the military reservation of California and headquarters of the department of the Pacific, is just now the scene of active military operations occasioned by a large concentration of Western troops designed for the occupation of Manila. It occupies 1,600 acres which front upon the Golden Gate, in a situation most charming in natural picturesqueness, about four miles from the Pacific Ocean. A peninsula extends into the strait, contracting the entrance of San Francisco Bay to less than a mile in width, where the channel is deepest and the currents most strong. At the extremity of this peninsula and guarding the narrow passage stands Fort Winfield Scott, an immense pile of brick and mortar, and mounting a hundred guns. The fort is now an abandoned structure, its strength in a military sense having departed. A 13-inch shell dropped inside the fort would immediately demolish it. The government no longer maintains a garrison here, only a sentry, to keep the too curious from depredation, being maintained at the present time. The situation, however, commands the channel, and upon the bluffs above the fort and on the hills which rise precipitously on the opposite shore are seventeen mortar batteries, dynamite guns and monster cannon.

The Presidio is regarded as a sort of sanitarium for the department, where soldiers fresh from the arid plains of the interior can there recuperate in a climate remarkably genial and temperate. The government has spent large sums in beautifying the place, in laying out roads and planting trees and flowers. Practically, it is an addition to the park facilities of San Francisco, and at all times its magnificent views of ocean, bay and shore collectively form one of the most superb attractions that can be found upon the continent.

Until Dewey's victory at Manila the chance of Western soldiers being needed on the opposite side of the globe had, apparently, never occurred to the military authorities. The reserves from the regular army were dispatched to New Orleans bound to Cuba, and the sudden demand for troops for Manila found the post almost denuded of available forces. Orders were hastily sent to concentrate in San Francisco, the quotas from Washington, Oregon, Colorado and California, and in a few days 7,000 of the finest, lustiest and most magnificent specimens of manly strength to be found in the whole world were encamped on the slopes of the Presidio.

Accommodations had to be improvised to some extent, and the government's resources were severely taxed in supplying rations, uniforms, tents and blankets on such short notice. San Francisco, though always an important military station, had never before seen war on such a scale.

The whole population flocked to the Presidio, and in one day over 100,000 people were on the grounds. The sudden call for troops found the government unprepared with transportation for so large a force, but the resources of the port are so great that no inconvenience or delay resulted. The first troop ship to be chartered was the "Peking," one of the best steamships of the Oriental and Occidental fleet. The "City of Sydney," belonging to the Panama line, and the "Australia," of the Oceanic Steamship Company, both vessels of the first class, were afterward engaged.

On May 25 this flotilla sailed for the East under circumstances most impressive.

A new chapter of history began as the three great vessels passed out of the Golden Gate. The "Peking" bore a regiment of the First California National Guards, and was crowded to the last inch. This regiment is composed of the flower of the youthful manhood of San Francisco, and the march from the Presidio down Van Ness Avenue and Market Street to the dock was one of the most impressive of scenes. The avenues were crowded with people, among whom not one but had some personal tie with the departing troops. Such a vast crowd, controlled by emotions that could not find expression, was never seen before. The gravity of the occasion was felt to its fullest extent.

The regiment marched to the dock and was hastily put aboard the ship. The "Peking" then drew into the stream and real military discipline commenced. The steamships "City of Sydney" and the "Australia," with the Fourteenth regiment of United States infantry and volunteers from Oregon, were next to load, and at five o'clock in the evening the three steamers started for Manila. The bay was alive. Every tug or steamer, every rowboat, was pressed into service and as long as possible kept the steamships in view.

SINGING FLAMES.

In a recent number of The American Journal of Science, Mr. H. V. Gill has an interesting paper on "The Theory of Singing Flames." The phenomenon of a gas jet burning inside an open tube emitting a musical note is one of those facts which, although known for many years and much written about, has never been fully explained. Among the more interesting theories was that of De la Rive, who supposed the sound to be due to a periodic condensation of the water vapor produced in the combustion of hydrogen gas. Faraday showed the inadequacy of this theory by the use of a flame which did not form water vapor, and proposed in its stead the theory that the so-called singing was caused by successive periodic explosions of a mixture of gas and air. This was accepted by Tyndall. Another theory which has been proposed is that the sound is produced by vibrations maintained by heat, the heat being communicated to the mass of air confined in the sounding tube at a place where, in the course of vibration, the pressure changes. Sondhauss performed a series of experiments, his chief conclusion being that the condition of the column of gas in the supply tube had an important influence on the phenomena. Mr. H. V. Gill sums up his conclusions as follows: "We think we have made it clear that the pressure on the gas plays the important part in this phenomenon, and that a consideration of the reactions we have described will be found to explain the many facts noted in the case of a singing flame, some of which we have alluded to. We look, therefore, on the chief cause as a mutual reaction between the pressures in the tube and on the gas, the energy necessary to sustain the note being supplied by the pressure on the gas and the action of the flame. We may compare the singing flame to the siren, in which the current of air causes the disk to rotate, the note being produced by the reaction of the disk on the current of air. . . . We have, then, three kinds of singing flames, one depending on changes of pressure, another on air currents, and a third depending at once on both changes of pressure and on air currents."

ANALYSIS OF AIR BY A MUSHROOM.

By causing various green plants to vegetate in nitrogen gas containing some carbonic acid, I became convinced that they are essentially anaerobic, that they can vegetate without free oxygen, that they are the means by which nature has provided the atmosphere with free oxygen, and that as the composition of the air gradually changed, becoming more and more oxygenated with the lapse of centuries, plants of aerobic nature and animals appeared.

If I place over water in a glass bell full of nitrogen containing some carbonic acid, a green plant such as Lysimachia nummularia (moneywort), for instance, the atmosphere of the bell soon will be proved to contain oxygen, and in a few months it will be even richer in oxygen than the external atmosphere.

In Agaricus atramentarius, on the contrary, we have the example of a plant (animal?) composed of aerobic cells which cannot vegetate without free oxygen, and which is capable of analyzing the air as completely as does a stick of phosphorus.

Thus, if I place over water in a graduated glass bell full of air (that is nitrogen containing some oxygen) one of these mushrooms which is entirely plunged in the air, i. e., not in contact with the water, and expose it to the solar light, as I did with my green plants, I soon remark a considerable condensation of water vapor, and then all the oxygen is absorbed. The carbonic acid produced being dissolved in the water, the latter rises in the bell glass. For instance, in a small bell glass of 200 c. c. capacity, the level of the water in a few days will be 160 c. c., and remain there. The bell glass contains then only nitrogen, and the mushroom will dry up in it, and can thus be preserved, for its vegetation has ceased. It is, in fact, mummified in nitrogen.

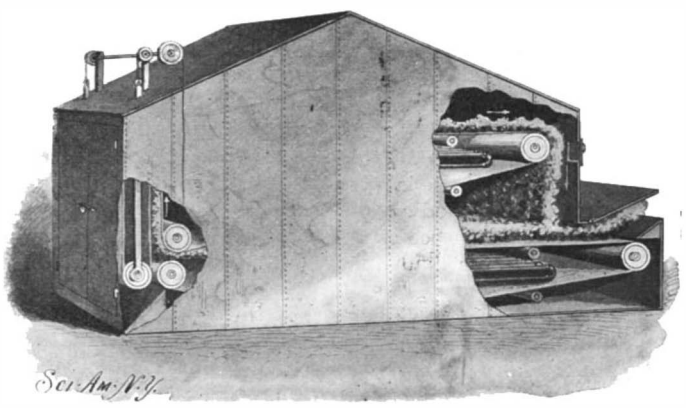
If I immediately place a green plant, such as the Lysimachia already mentioned, alongside of the Agaricus, I find that in a few days the latter will sometimes recommence slowly to vegetate; but the green plant providing more oxygen than the mushroom can utilize, the level of the water will soon stand at about 180 c. c.—D. T. L. Phipson, in Chemical News.

© 1898 SCIENTIFIC AMERICAN, INC.

AN EFFICIENT WOOL-DRIER.

The wool-drier which we illustrate is, in general, characterized by a casing in which a series of endless carriers or aprons are arranged mounted on rollers, the casing being heated by steam pipes, so that the wool, in circulating, is dried by the action of the radiating heat. The apparatus is the invention of James W. Spencer, of Olneyville, R. I.

The casing of the apparatus has a projecting lower portion provided with a feed orifice, which may be closed by a hinged cover. An endless apron, with two horizontal runs, is mounted in the lower portion of the casing and extends beneath the feed orifice. A second endless apron is mounted in the casing above the first apron, and has three runs, one extending upwardly from the first apron, another extending horizontally, and a third extending diagonally between the first and



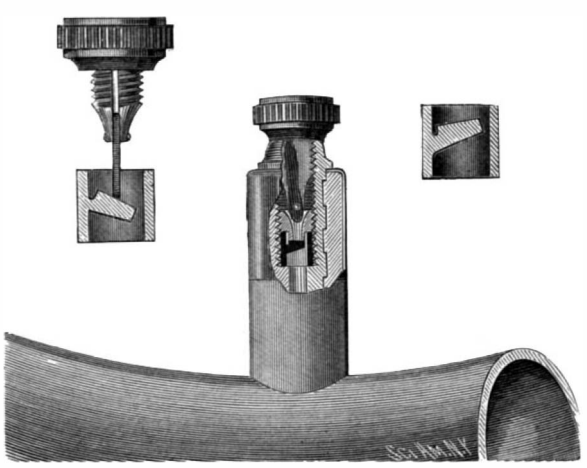
SPENCER'S WOOL-DRIER.

second runs. At the rear of the casing a third endless apron is vertically mounted and passes in close proximity to the vertical run of the second apron. This third apron is so mounted that it may be raised or swung aside to permit the discharge of the wool through a door in the casing. Steam-heating pipes are horizontally placed between the runs of the first and second aprons. An observation opening is cut in the casing above the forwardly projecting portion.

In operation, the wool is fed through the proper orifice, until the machine is sufficiently charged. The cover is then closed. The wool passes along the top run of the lower apron, up between the vertical run of the second apron and the front run of the third apron, then forward on the horizontal run of the second apron, to fall back upon the lower apron, whence it is carried rearward again. The operation is repeated until the wool has been sufficiently dried. The wool is then discharged by opening the door in the rear and swinging the apron aside.

A NOVEL VALVE FOR PNEUMATIC TIRES.

A valve for pneumatic tires has recently been patented by William G. Urmson, of New Brunswick, N. J., which is so constructed that all the parts may be readily replaced when necessary. The valve casing is designed to be inserted through the rubber nipple extending from the tire, and is provided with exterior ribs to retain it in place. An outwardly extending flange on the upper portion of the casing obviates the danger of forcing the casing too far into the nipple. On the outside of the nipple a supporting and strengthening thimble is fitted. The casing is interiorly threaded, and at the base of the threaded interior a



URMSON'S VALVE FOR PNEUMATIC TIRES.

valve seat is formed. A valve carrier having an exterior screw thread is received within the casing and carries an inner flexible tube having an integral flap valve which, normally inclined, takes a firm seat against the valve carrier. The plug or cap for closing the valve casing is threaded and longitudinally slotted. Pivoted near its end in the slot is a tongue which may be caused to open the valve for deflating the tires. When it is desired to permit the air to escape, the tongue is allowed to fall from its normal position, so that the smaller end of the tongue will pass through the valve carrier by screwing the plug or cap inward to unseat the valve. The essential features of the invention are the improved flap valve, the upper flange on the casing, which prevents the inner end of the casing from coming into contact with the opposite side of the tire, and the novel deflating devices.

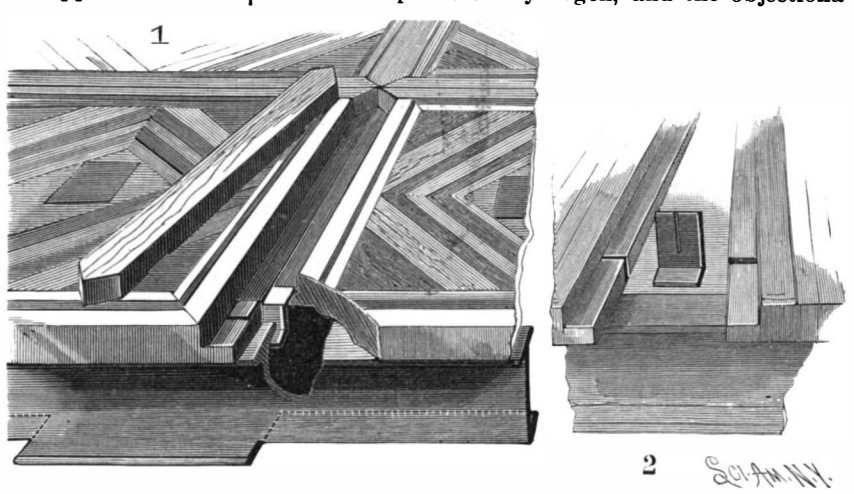
Test of Antiseptic Substances.

In the Zeitschrift für Angewandte Chemie, Th. Bokorny, says Science, gives the results of a study of the antiseptic action of various substances. A culture medium of half per cent egg albumen or peptone, with one-tenth per cent potassium phosphate, two-tenths per cent magnesium sulphate and a trace of calcium chloride was infected with the bacteria of decay, and after addition of the substance to be tested placed for several days in an incubator. Among inorganic compounds, silver nitrate and mercuric chloride have about the same value, 0·002 per cent killing all organisms in two days. The antiseptic limit with silver nitrate is 0·0002 per cent; with mercuric chloride, 0·001 to 0·0002 per cent. Copper sulphate is nearly as active, 0·005 per cent killing all organisms in twenty-four hours and 0·001 per cent preventing decomposition. Zinc sulphate 0·01 per cent kills infusoria in eighteen hours, but 0·1 per cent is not completely antiseptic, while cadmium sulphate toward algæ and infusoria is weaker than the zinc salt, but toward bacteria stronger, 0·02 per cent being antiseptic. Lead acetate and nitrate in 0·1 per cent solution only delay decay, while it is prevented by the same strength of iron sulphate solution. The fluorides are not strong antiseptics, the limits being for hydrofluoric acid 0·02 per cent, barium fluoride 0·3 per cent, aluminum fluoride 0·1 per cent, calcium fluoride 0·03 per cent, ferric fluoride 0·06 per cent, magnesium fluoride 0·05 per cent. Ammonium fluoride 0·1 per cent is without action, but sodium fluoride 0·1 per cent is antiseptic; potassium fluoride is rather more active.

AN IMPROVED FLOORING.

The engraving which we present herewith illustrates a flooring which can be readily secured in place and which will not warp. The flooring in general consists of boards provided on their sides with rabbets for forming bottom flanges which are transversely slotted. Clamping irons are made to pass partially into the slots and are provided with arms adapted to be bent down over the board flanges. Of our illustrations, Fig. 1 is a perspective of the flooring with a portion broken away to show the clamping iron bent in position, and Fig. 2 represents details of construction.

The flooring comprises a series of rails formed at their lower ends with flanges located alternately on opposite sides of each rail. The rails are embedded in a layer of cement and firmly on the alternate flanges. On the upper end of each rail extends a continuous horizontal flange. Over the hardened cement a thin coating of tar is poured and on this coating boards are placed, which at adjacent sides are formed with rabbets to produce bottom flanges, transversely slotted in a line with the upper continuous flange of the rails. These board slots receive the bodies of the clamping irons. The lower bent ends of the irons pass under the upper continuous rail flanges, a suitable opening having been made for that purpose in the hardened cement. The upper end of each clamping iron is formed with two arms, which are bent in opposite directions over the adjacent board flanges. A covering strip cut out at its under side may be made to receive the arms of the clamping irons bent down upon the flanges. The top of the strip is flush with the boards and can be nailed in position. By the arrangement described, the boards are securely fastened in place, so that they are prevented from warping. Longitudinal shifting is prevented by the transverse clamping irons extending into the adjacent side flanges of the adjoining boards. The flooring has been patented by Thomas Cantwell, No. 1809 Amsterdam Avenue, New York city.



CANTWELL'S FLOORING.

A Friendly Criticism.

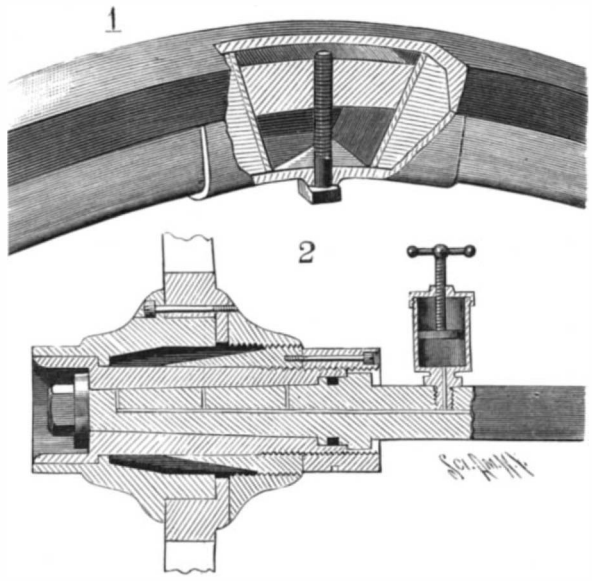
The following amusing but brief review of the NAVAL SUPPLEMENT recently appeared in The Electrical Engineer, of London:

We have received the SCIENTIFIC AMERICAN NAVAL SUPPLEMENT and find in it most interesting and fully illustrated descriptions of the different types of vessels in the United States navy. The only fault we find with the paper is a note to the effect that it was entered as second-class matter at the New York post office. It is a first-rate issue in spite of the above.

A NEW VEHICLE WHEEL.

The subject of the accompanying engraving is a vehicle wheel characterized chiefly by the novel form of the hub and felly expanding devices, and patented by Robert G. McDowell, of Anaconda, Mont.

The hub of the wheel is provided with a front ring having wedge-shaped inward projections which receive between them the tenons of the spokes. Another ring has forward projections which extend between the spokes outside of the first named projections, as seen in



McDOWELL'S VEHICLE WHEEL.

both our illustrations. The rear portion of the hub is formed by a ring having a threaded interior screwing upon a threaded tapering sleeve movable on the hub-box. This tapered sleeve fits beneath and wedges against the spoke tenons, and by its means the spokes may be forced outwardly or may be allowed to fall inwardly. The sleeve is held in place by a ring screwing upon the hub-box and acting after the manner of a jam-nut. Bolts may be employed to hold the various parts together. A lubricator is provided consisting of a piston with a screw-rod which forces oil from the cup into proper channels in the hub-box. In a hub of this construction the spokes and other parts may be readily adjusted when shrinkage has loosened them.

A device whereby the felly may be tightened upon the tire is also provided. The device consists of a wedge-shaped block whose inclined sides coact with the similarly beveled ends of the felly. From the block through a plate on the interior circumference of the felly a screw passes which enables the block to be drawn toward the hub so as to expand the felly.

Dangerous Odors.

The Boston Transcript tells its readers what smells are dangerous. A single sniff of highly concentrated prussic acid will kill a man as quickly as a shot through the heart. The odor of a bad egg is due to the presence of sulphureted hydrogen, and the objectionable perfumes of sewers and bone factories are attributable chiefly to the same gas. Chemical laboratories are famous for bad smells. Berzelius, who discovered the element called "selenium," once tried the experiment of permitting a bubble of pure hydrogen selenide gas to enter his nostrils. For days afterward he was not able to smell strong ammonia, the olfactory nerves being temporarily paralyzed. Selenium gas has the odor of putrid horseradish. Tellurium is even worse. There is a story of a physician whose patient, a lady, refused to take an absolutely necessary rest because she was so fond of being always on the go in society. He gave her a pill containing a small quantity of tellurium, and her breath was affected by it to such an extent that she was not able to appear in public for a month. She never guessed what the trouble was. The volatilized essential oil of roses is supposed to cause "rose cold." This peculiar complaint is so far nervous in its character that paper roses sometimes excite it.

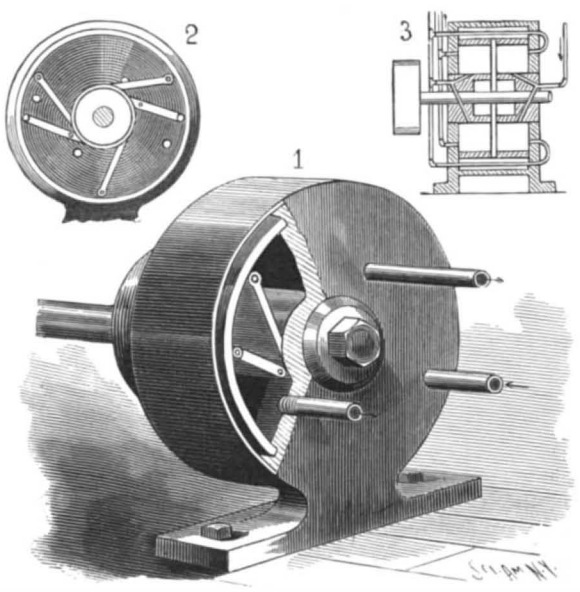
© 1898 SCIENTIFIC AMERICAN, INC.

A NEW ROTARY ENGINE.

Of the accompanying illustrations, Fig. 1 represents a perspective view of a new rotary engine with a portion broken away to show the interior, Fig. 2 a sectional side elevation with the piston-heads and abutments in position, and Fig. 3 a modification in section, showing a compound engine.

The engine is provided with a casing formed with a hub against which abuts a wheel-like piston having a solid web and a rim concentric with the hub. The piston thus forms an annular working chamber with the casing. Piston-heads are pivoted near their outer ends to the web of the piston and are mounted to swing in the working chamber. The inner ends of the piston-heads are provided with friction rollers which travel on the surface of the hub. Abutments are pivoted near their inner ends to the hub at opposite points. At their outer ends the abutments carry friction rollers traveling on the inner surface of the piston rim. The abutments and piston-heads are so arranged that when the piston rotates, the piston-heads swing outwardly, so as to pass the inwardly swinging abutments. Oppositely arranged inlet ports open into the working chamber at a point forward of the abutments. Oppositely arranged outlet ports open into the working chamber at the rear of the abutments. When the steam enters the inlet ports, it presses against the piston heads, which have their rollers against the hub and their outer ends against the piston-rim. Similarly, the steam acts on the abutments so as to hold their friction rollers on the piston rim. The action of the steam on the piston-heads causes the piston to revolve. The piston simultaneously receives a like impulse from the steam passing into the space between the corresponding abutments and piston-heads. When each piston head passes an exhaust port, then the steam in the rear of the piston-head can exhaust. As each piston-head passes over an exhaust port, another piston-head passes the preceding inlet port, thus giving impulses imparting a continuous rotary motion to the piston.

The engine has been patented by William Willerton and Thomas Shortliff, of Blackfoot, Kipp P. O., Montana.



WILLERTON & SHORTLIFF'S ROTARY ENGINE.

AUTOMOBILE CARRIAGE FOR WINTER USE.

Our engraving shows an interesting modification of the automobile carriage for winter use on snow and ice. It is the Bollee gasoline carriage adapted for running on hard winter roads by being mounted on steel runners, and the driving wheel being provided with a wooden rim, studded with conical points, this rim being substituted for the pneumatic tire on the driving wheel. The carriage was rebuilt for winter use by Dr. E. Casgrain, of Quebec, Canada. It is an interesting development of the automobile vehicle and opens another field for those who are working on the important problem of automobile propulsion.

The Bollee carriage has an enviable reputation in France, where it is made, as a thoroughly practical vehicle. The ordinary Bollee carriage is illustrated in the SCIENTIFIC AMERICAN for October 17, 1896. It is a machine of the tricycle order, with two steering wheels in front and the driving wheel behind, but in Dr. Casgrain's modification steel runners are substituted for the front wheels. It is characterized by a very low form, which assures great stability, which is an added advantage for use in winter, when the inequalities of the road are more apparent than in summer. There are two seats; and the motor and the gasoline reservoir are in the rear, the former being upon each side of the driving wheel. The frame of the carriage is formed entirely of hollow tubes. The gasoline reservoir has a capacity of seven quarts—sufficient for a run of fifty miles. The gasoline descends to the carbureter by gravitation, passing through a Panhard and Levassor flow regulator containing a hollow brass float that follows the movement of the liquid. A conical plug closes the inlet orifices when the influx of the liquid is too great. After the gasoline reaches the carbureter it spreads over a bronze cap and is reduced to an extremely fine state of division, and in this form is carried along by a current of air regulated by a clack valve. By means of a rod it is possible to uncover the holes of this valve more or less, thus modifying the composition of the gaseous mixture in such a way as to render it explosible, thus adapting the explosive mixture so as to run the motor at the desired speed. Ignition is effected by means of a platinum igniter heated by an external burner. The motor is of the four-cycle type and it develops two horse power. The cooling is effected through heat regulators having lugs cast upon them as shown in the engraving. The connecting rod and crank move in a bath of oil. The velocity of the motor is regulated by an apparatus which acts upon the exhaust valve, which, when the motor is running wild, prevents the lifting of this valve and, consequently, an expulsion of the burned gases and the introduction of a new charge at the succeeding revolution.

While the motor runs normally, the valve is directly controlled through the medium of the levers and rods by a box fixed upon an axle parallel with the driving one. This box actuates a link and transmits motion to the valve. The valve is pulled back by means of springs. The gases, after their egress from the cylinder, pass into an exhaust cylinder designed to deaden the noise and are finally expelled. The motor is stopped and started by an ingenious device. The axle of the driving wheel is movable backward and forward through the intermedium of a lever placed at the left of the driver. This lever moves opposite a toothed sector at whose notches it may be arrested. The motion of the driving axle is communicated to the wheel by means of a drum keyed to a hollow shaft that receives its motion from the driving axle. This drum, through a rubber belt, carries along another and larger one that is dependent upon the wheel. When the lever is shoved backward, the driving wheel moves forward and loosens the belt, which can then no longer rotate the wheel. At the same time the latter applies itself against the fixed brake block and is arrested on the spot. But if, on the contrary, the lever is shoved forward, the wheel moves backward and stretches the belt, and an opposite effect is produced. This arrangement has the advantage of obviating the inconvenience of the stretching of the belt, since, in order to tighten it, it suffices, upon starting, to push the lever one notch forward. The carriage is provided with a train of three different gearings, that permit of obtaining speeds for five, nine and fifteen miles an hour. As may be seen, the person who sits in front does not aid in the steering of the vehicle. The steersman sits behind, his feet resting on each side upon a platform provided with a straw mat. He merely has to move his foot backward in order to press the lever of a powerful brake whose block is tangent to the circumference of the driving wheel. With his right hand he steers the vehicle through a hand wheel, which, by a very simple gearing, turns the fore wheels to the right or left.

DR. CASGRAIN'S BOLLEE CARRIAGE FOR WINTER USE.

The Perplexing Gas Meter.

Most gas consumers on this side of the Atlantic have like experience to a facetious correspondent in The London Graphic, who asks as follows: Can anyone tell me if gas meters suffer from aberration of intellect, and if so whether there is such an institution as an Asylum for Demented Gas Meters? If so, I should be very glad to hear of it, and at once institute a commission de lunatico inquirendo, and have the case of my especial meter thoroughly investigated. I have spoken before of the difficulty of tackling even a sane meter. I know a great many very clever people, but there is not one among the lot understands the language of a meter, even when it is in its right mind. Give the most well-informed person of your acquaintance a ladder and a candle and tell him to climb to your meter and inform you how much gas you have burned, and you will find him absolutely puzzled. What then can you do with a mad meter, one that persists in registering an increase of gas every quarter, though you feel certain that you consume nearly the same quantity in every corresponding period of each year? If the management of meters and the reading of the same were taught in schools, it would be better than much of the useless learning which is crammed into children's heads.

© 1898 SCIENTIFIC AMERICAN, INC.

Science Notes.

A prize for an essay on "The Duty of Kindness to Animals," offered by the S. P. C. A. and competed for by London public school children, brought the society 136,465 essays this year.

The lighthouse on Armish Rock, in the Hebrides, is about 500 feet from the shore. To avoid having an attendant on the rock, the light is produced on the shore and projected across the water upon a mirror in the lighthouse, the mirror reflecting the light in the desired direction.—Der Westfale.

American scholars go over to Germany to acquire scholarship, but German professors come to America for new ideas in the way of illustrative apparatus. Prof. Magnus, who holds the chair of botany in the University of Berlin, was the guest of Prof. Atkinson at Cornell University for a week or two last fall. He was much interested in the photographic collection of the department, and made arrangements to have sent to him a list of photographs of mushrooms and a series showing the effects of fungi in producing decay of forest trees—duplicates of those used at Cornell. Word has just been received from him acknowledging the receipt of the photographs, and returning his thanks for them, saying: They are of very great use for my lectures, and the students have seen them with great interest.

Much attention has been paid to the boarders, welcome and unwelcome, in ants' nests, says The Independent. It is well known that ants keep cows, i. e., the aphides, whose "honey" they feed upon. Various beetles, mites, pill bugs, etc., only occur in ants' nests. One beetle (Claviger testaceus) found in the anthills of Paris is so dependent that it perishes on being removed from the care of the ants. Janet now tells us that the "silver pit" or "slick," as they are called locally in New England (Lepisma), enter ants' nests and live what Janet calls a myrmecocteptic life. When the ants (in confinement) were fed with small drops of honey and pairs of them became locked together by their jaws, the Lepismæ would rush in between them and intercept the drop or a portion of it in its passage and then precipitately retreat, but only to beat another pair in a similar way, and so on until its hunger was satisfied. Hence the Lepisma is a dietetic sneak thief.

The transfer of bacteria by subsurface water has lately been tested by a number of experiments in a clearing of the forests bordering the Rhine near Strasburg. In an elaborate article by Prof. E. Pfuhl in the Zeitschrift fuer Hygiene, it is stated that two pits were used in the tests. One was 3·3 feet deep, and in it the ground water rose to within about 1·6 feet of the surface. The other was 24 feet distant in a line perpendicular to the direction of the flow of the subsurface water. This second pit was 4·9 feet deep, 3·3 feet wide and 39 feet long. Two species of bacteria, Micrococcus prodigiosus and the fluorescent vibrio, which do not occur in the Rhine, were selected for the experiments. The cultures of these species were introduced into the first pit, and at intervals of about half an hour samples were taken from the second pit and cultivated in the usual way on gelatine or agar plates. It was found that in an hour the micrococci and in two hours the vibrios had passed through the 24 feet of gravel separating the pits. In other experiments, the micrococci were found to pass into the supply of a tube well drawing its supply through gravel from a distance of 12 feet from the place where cultures of the bacteria were inserted in the water near the surface.

As is well known, Americans born of foreign parentage are larger than their ancestors, whether English, Irish, German or French; and Dr. Bowditch has shown that the children of Americans of both sexes, born in the United States, are larger than those of foreign races, says The Independent. This is generally attributable to difference in the climate of the Old and New Worlds, our American climate being drier, more changeable and stimulating than that of Europe. It appears that the introduced English sparrow has undergone a gradual modification since its introduction, about thirty years ago, into this country. Dr. H. C. Bumpus has critically examined over 1,700 eggs of this bird, one-half from England and the other half from Providence, R. I. It was, says Science, found that the eggs of the American race, or breed, vary much more than the European, that they are smaller and of a strikingly different shape, being more rounded and with a much greater amount of color variation. This is attributed by the author to a suspension of natural selection. However this may be, it belongs with the class of facts which show that the modification is primarily due to the change from one climate to another. Cockerell has found that common European snails introduced into this country soon begin to present variations not known to exist in England, while in the introduced butterfly, Pieris napi, twelve American varieties, and of P. rapæ four varieties, have appeared on American soil, within the few years which have elapsed since their appearance and spread on this continent.

Miscellaneous Notes and Receipts.

Production of Etching Varnish.—Melt together 4 parts of wax and 2 parts of black pitch and add gradually 4 parts of powdered asphaltum. The whole is carefully boiled, which is kept up until a sample put on tin breaks on bending between the fingers, whereupon balls are formed from the mass.—Seifensieder Zeitung.

Colored Aluminum Alloys.—A purple composition scintillating in the reflexes of the ruby is produced by an alloyage of 78 parts gold and 22 parts aluminum. With platinum, a gold-colored alloy is obtained; with palladium, a copper-colored one; and with cobalt and nickel, a yellow one. Easily fusible metals of the color of aluminum give white alloys. Metals difficult of fusion, such as iridium, osmium, titanium, etc., appear in abnormal tones of color through such alloyages.—Werkstatt.

According to a French patent of Anquetil, ink of the following composition gives copies on unmoistened copying paper without application of pressure:

Aniline color	30 grammes.
Water	2000 "
Glycerine	1000 "
Alum	15 "

It suffices, in order to obtain good copies, to lay a sheet of paper written on with such ink in the copy book, and to close the latter. It is only necessary to see to it that the writing comes into contact with the copying paper throughout.—Papier Zeitung.

Improved Method of Mercerizing Cotton.—C. Ahnert, of Paris, has received a French patent for a method of imparting a silky gloss to cotton not in a state of tension. He says the tension of cotton in the treatment with soda lye for producing such luster is unnecessary if it has, before entering into the lye bath, been saturated with soap solution. His improved method is as follows: The well-boiled cotton is impregnated with a concentrated soap solution at 122° F., and entered into the alkali bath of a concentration of 25° to 35° B. and a temperature of 86° to 104° F.; the cotton is taken out in two and a half to three hours and rinsed with water, to which an acid may be added. It is next bleached.

Plated Sheet Aluminum.—Wachwitz has invented a process for plating sheet aluminum which is said to remove the difficulties heretofore connected with the working up of aluminum. Copper-plated sheet aluminum can be worked up like copper plate and can be soldered, folded, tinned, nickel-plated, etc. The copper adheres in a thin layer on the aluminum, so that hardly any increase in weight is caused, and the coherence of the two metals is such that no separation ensues on rolling or stretching. The plating also renders the aluminum more resisting to bending, to blows and knocks. Copper-plated aluminum wires, which can be readily silvered and gilded, are likely, under the above suppositions, to gain importance in the wire industry and electrotechnics. As regards the latter, it is very important that aluminum is non-magnetic and possesses great conducting power for heat and electricity.—Dampf.

Bronzes from Metallic Oxides.—As a rule, bronzes for decorative purposes are produced in the shape of finely powdered metals or metallic alloys. By the following methods handsomely colored bronzes can be obtained from metallic oxides and solutions:

White Bronze.—Chemically pure zinc sulphate, free from iron, is subjected for some time to calcination in an earthen retort.

Silver Bronze.—Mix 1 kilo of a concentrated solution of zinc sulphate with 30 grammes of cobalt nitrate, 30 grammes of nickel nitrate and 10 to 15 grammes of copper nitrate, all in solutions of 15° to 16° B. density, and calcine after evaporation. The longer calcination is carried on, the darker the color becomes.

Light Pink.—Mix 1 kilo of zinc sulphate solution with 30 grammes of iron nitrate solution of 20° to 25° B. and calcine after evaporation.

Leather Color (Yellow).—Treat 1 kilo of zinc sulphate solution and 12 to 30 grammes of an iron sulphate solution of 28° to 30° B. as above described.

Yellow Gold.—Treat as above 1 kilo of zinc sulphate solution and 28 grammes of manganese nitrate solution of 12° to 14° B. The duration of the calcination regulates the shade.

Yellow Green is obtained from 1 kilo of zinc sulphate solution and 25 grammes of nickel nitrate solution of 15° to 16° density, with slight admixture of silver nitrate solution.

Greenish Vermilion.—Dissolve 90 grammes of iron sulphate, filter, and add to the filtered solution 120 grammes of ferrocyanide, whereupon a bluish green precipitate results. Now a concentrated solution of 400 grammes of alum is stirred in and subsequently 100 grammes of finely powdered lime are added, and after the effervescing is over, 900 grammes of lead acetate. The precipitate obtained is washed, dried at moderate heat and finely pulverized. These pulverulent colors give good bronzes with bronze oil; ground in varnish, they furnish paints of good covering power.—Färben Zeitung.

German Shipbuilding in 1897.

The Kolnische Zeitung of January 16 has an interesting summary of the results of shipbuilding in Germany in 1897, of which the following précis has been forwarded to the Foreign Office by H. M. Ambassador at Berlin:

Shipbuilding, like all other industries in the past year, has every reason to be satisfied with its development. It has been said that German shipbuilding can now consider itself to be on an equal standing with that of other countries; but this opinion applies rather to special ships constructed than to shipbuilding as a whole.

It is very instructive to consider for the past year the figures for ships and tonnage built. It will then be seen that, though Germans have much reason to be satisfied with the results, they must yet acknowledge that they are far behind Great Britain, and have no reason to rest on their present laurels.

In 1897, seventy-nine ships were launched from 28 yards, in which figures are included only seagoing vessels of at least 100 registered tons. This represents a total of 185,000 tons. The bulk of this tonnage is in passenger steamers, about 40,000 in eight men-of-war, and 2,600 in sailing ships. This shows that the construction of sailing craft, being only about 1 per cent of the whole, is practically at an end. And this small tonnage built at home has only been increased by some 500 tons of foreign built sailing ships. This consideration is unsatisfactory from the point of view of training up crews for sea service.

Turning now to the construction of steamers, it is seen that for merchant shipping German yards have tried many varied types, and not only for special designs. Large steamships have been built with their powerful machinery and complete fittings fulfilling all the many requirements of the passenger steamers of the day, in which branch the two large companies of Hamburg and Bremen (the Hamburg-American and North German Lloyd Companies) take the lead. German yards are also turning out special kinds of ships, such as ice breakers (of which many are for Russian account), petroleum steamers and steamers for high-sea fisheries. Whereas Holland and England have earned enormous sums by fishing on the high seas, Germany stands in this respect even behind France and Belgium, on account of the protection accorded to this industry by the government and by the activity of patriotic companies. Fisheries of the high seas are now gaining some importance, and there are over one hundred steamers employed in fishing, all of which have been built in Germany.

With the exception of a few orders from Russia, the merchant vessels were built for the account of Germans. Such a result, viz., that Germans can, to a great extent, now supply their own requirements, must be regarded as most satisfactory, when one remembers the well merited standing and renown of British yards, and their advantages as regards low prices for coal and iron.

Thus the Germans have reached the first stage which should encourage them to strive for the second step, which is the attainment of orders from abroad for German built vessels. With regard to men-of-war, they have already succeeded in this respect. Of the 50,000 tons of men-of-war built in late years, 23,000 were constructed in private yards and 27,000 by the government. Besides the seventy-nine ships of 185,000 tons built at home, there were ordered abroad thirteen other ships of 32,000 tons. A torpedo destroyer of 500 tons was also ordered in England. The present position is therefore a most satisfactory one for Germany when her former dependence upon foreign countries is remembered.

Quick Journeys Made Now.

A French statistician has just drawn up an interesting document showing at various periods in what time certain frontier towns could be reached from Paris. The years chosen are 1650, 1782, 1834, 1854 and 1897. In 1650 it took five days to go from Paris to Calais. One hundred and thirty-two years later, in 1782, the duration of the journey had been reduced to sixty hours. In 1834 it had fallen to twenty-eight hours, and in 1854 to six hours forty minutes. To-day one of the boat expresses takes three hours forty-two minutes.

The journey to Strasburg took two hundred and eighteen hours in 1650, one hundred and eight hours in 1782, ten hours forty minutes in 1854, and to-day a matter of eight hours twenty minutes.

The difference for Marseilles is still more phenomenal. From fifteen days in 1650, the duration of the journey was reduced to eighty hours in 1834, and to-day it takes twelve and one-half hours. The distance from Paris to Bayonne two centuries ago took three hundred and eighty-eight hours; to-day it occupies eleven hours eleven minutes. Brest can be reached in thirteen hours thirty-seven minutes, while in 1650 it took two hundred and seventy hours. Finally, for Havre, ninety-seven hours was considered quick traveling in 1650. It took fifteen hours in 1782 and seventeen hours in 1834. To-day it is a matter of three hours fifteen minutes.

© 1898 SCIENTIFIC AMERICAN, INC.

THE SPANISH TORPEDO-BOAT DESTROYER "TERROR."

Persistent reports of conflicting nature are being circulated regarding the Spanish torpedo-boat destroyer "Terror," to the effect she has been destroyed by the United States fleet off Santiago de Cuba. Though these reports lack verification, a description of the craft in question may be of interest.

The "Terror" and her sister ship "Furor" were contracted for by the Spanish government, and built near Glasgow, Scotland, by the Clydebank Engineering and Shipbuilding Company (Limited), during 1896 and 1897; and both were supposed to represent the most advanced type of naval construction and armament in their class. Though laid down on the general lines adopted by the Admiralty Board of the British navy, these craft differed slightly therefrom, chiefly in matters relating to the accommodation of officers and crew, and specially as regards service in tropical seas. Impermeability to artillery is little considered in torpedo-boat destroyers, inasmuch as they are supposed to rely upon a low freeboard, their speed and ability to maneuver quickly to avoid the fire of an enemy, and upon an armament of rapid-fire guns to resist attempts at boarding.

The "Terror" is (or was) 220 feet long and 22 feet beam, over a moulded depth of 13 feet, with a total (loaded) displacement of 380 tons, and driven by triple-bladed twin screws, each with four-cylinder triple expansion vertical engines. Her contract called for a speed of 21·5 and 28 knots, respectively, under natural and forced draught, and on her trial trip she is reported to have exceeded the former by a full knot and the latter by one-half knot, on both occasions with a load of 75 tons; one of her sister craft sustained continuously, for two hours, under forced draught, a speed of 30·02 knots—approximately 34·2 miles.

The armament consists of two 14-pounder quick-firing guns, fore and aft, the former mounted on the conning tower; two 6-pounder broadside guns of like type; and two 37-millimeter automatic, quick-firing guns mounted, respectively, on starboard and port bow; all supplied by the Maxim-Nordenfeldt Gun and Ammunition Company (Limited), and representing the latest advance in naval artillery; in fact, the rapidity of fire, especially with the automatic guns, which are loaded and fired through the agency of the recoil, is described as a "hail of iron missiles;" also two torpedo tubes on the Schwartzkopff system, 14 inches in diameter, mounted on the upper deck so as to fire on either side. Four torpedoes are carried, along with complete sets of air compression machinery.

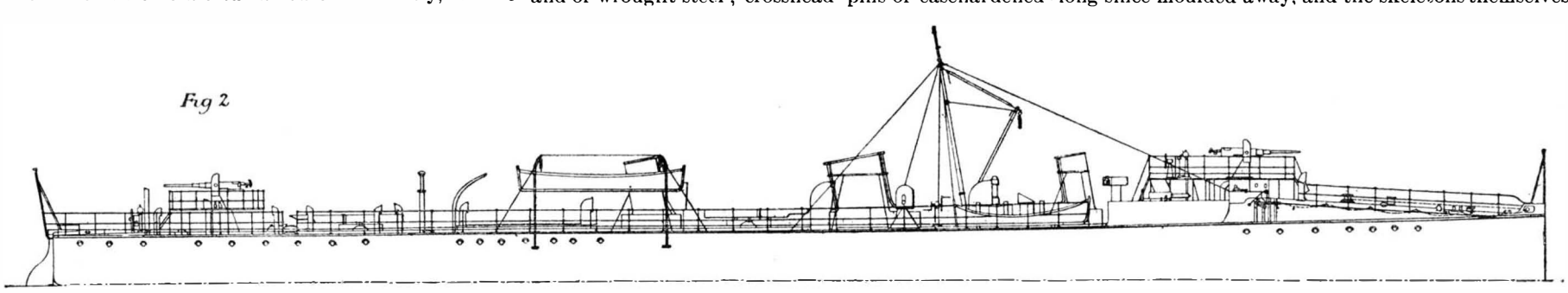
The steam power of these vessels is derived from four improved Normand boilers, with galvanized steel tubes, situated fore and aft in two separate watertight compartments. The two distal furnaces discharge each into its own funnel, but the midship pair have one large funnel in common. Forced draught is on the closed stokehole system, the air being supplied by two single-breasted fans in each firehold, placed one on either side of the bunker bulkheads, the air being admitted to them by large cowls directly overhead; the fan engines are of the open vertical type. The boiler feed consists of a main and auxiliary system of pumps and pipes, separate and entirely independent of each other. The main system consists of two of Weir's special feed pumps at the forward end of the engine room, each drawing from the hot well tank through a Harris patent feed water filter, and discharging either to the boilers in one compartment direct, or through a couple of Weir's feed water heaters, situate on the forward engine room bulkhead between the pumps. The feed water discharge to each boiler is controlled by a special automatic feed regulating arrangement which keeps the water at a steady level in the boiler. For the auxiliary system a similar feed pump is placed in each boiler room, and each pump is connected by separate pipes with the reserve fresh water tank, the hot well tank and the sea, and discharges direct to the boilers. The pump in the after boiler room also discharges to the deck and there serves the purposes of a fire pump.

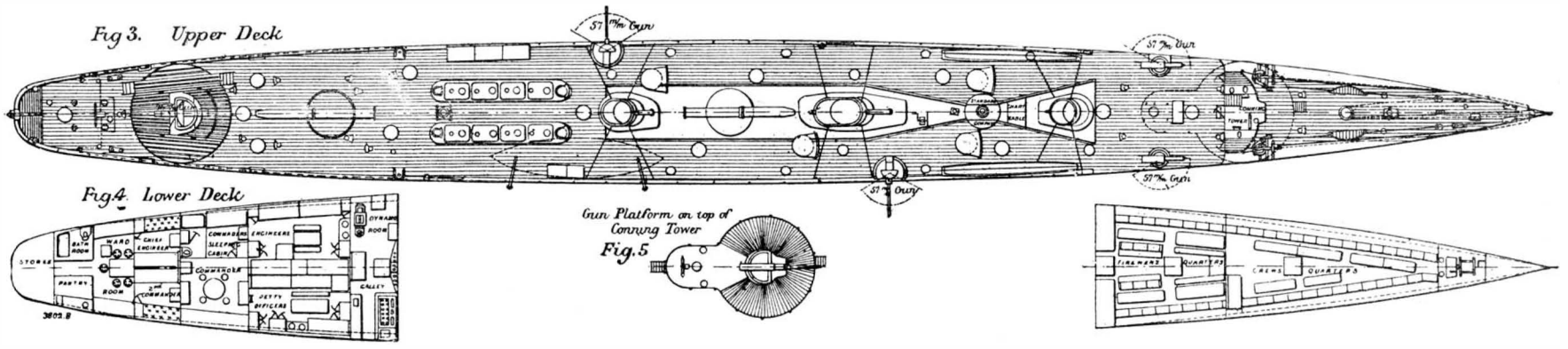
The main steam pipes are of galvanized steel. An independent pipe extends between each boiler room and one set of engines, and each pipe is fitted with a stop valve and steam separator on the engine room bulkhead, thereby insuring dry steam in the engine. There is also a connecting pipe between the main steam pipe and an equilibrium valve at each high pressure cylinder. An independent auxiliary steam pipe supplies all the auxiliary engines, fans, capstans, steam steering gear, etc, except the main feed pumps, and the exhaust steam is led by a system of pipes to either of the main condensers.

The four cylinders of each set of engines are separate castings, but bolted together and transversely stayed, and likewise stayed to the gusset plates in the wings connecting the frames and deck beams; also a pair of struts extend from each of the high pressure cylinders to gusset plates between the decks and forward bulkhead of the engine room, and like ties secure the low pressure cylinders. The cylinder bottoms, each a separate casting, are bolted to the cylinders, and they, together with the cylinder covers, and top and bottom covers of the valve casings, are of cast steel. Pistons of forged steel, turned throughout and fitted with Perkins metal rings; piston and connecting rods hollow and of wrought steel; crosshead pins of casehardened steel fixed in forks of the connecting rod; piston head, piston rod and piston rod guide, one complete forging, the latter with machined recesses filled with white metal on the "ahead" side; the "ahead" guide faces of cast iron, with water circulation at back; "astern" facings of bronze.

The bed plates also are of cast steel, each consisting of two angle bar shaped castings extending the whole length of the engine and resting on longitudinal frames extending between the engine room bulkheads. The main bearing frames extend between, at right angles, being checked into and secured to these castings, as well as to the floor of the vessel, by fitted bolts. The crankshaft and pins, and thrust and propeller shafts are hollow and of steel. The high pressure and intermediate pressure cranks are arranged opposite to one another, and each pair forged in one piece; balance weights appear on the crank webs in order to reduce the vibrations to a minimum.

A large evaporator is situated amidships on the after engine room bulkhead, with a capacity of 3,150 gallons per day of fresh water, beside which is a distilling condenser, capable of supplying 560 gallons daily of pure aerated fresh water, chiefly used for ship purposes, the remainder of the vapor going to the main condensers to serve as make-up feed. A separate engine, with pumps, is also fitted for maintaining the water level in the evaporators, circulating the condensing sea water and pumping the drinking water into the ship's tanks. An auxiliary air pump is fitted to each of the circulating pumps, and is connected to the bottom of the main condensers, discharging to the hot well tank. On the after engine room bulkhead there is also a duplex bilge pump, for clearing out the bilges of the engine and boiler rooms, and ejectors are fitted to each compartment, so that, in case of excessive flooding, the water may be rapidly got rid of. For the engraving of the engines we are indebted to London Engineering.





THE SPANISH TORPEDO-BOAT DESTROYER "TERROR."

Theater Sickness.

Under the name of mal de théâtre, we find in the Progrès médical, says The New York Medical Journal, an account of an affection often witnessed by physicians in theaters, according to the writer. It is manifested by loss of consciousness, faintness and even syncope. It generally occurs in persons who have dined hastily in a restaurant and reached the theater overheated. Pregnant young women are particularly disposed to it. The only treatment required is to loosen the clothing, lay the patient down, expose the face to fresh air, bathe the temples with a little cold water or cologne, and apply smelling salts. The patient should not be allowed to stand or sit up until the attack is thoroughly over, that is, for ten or fifteen minutes, and then he had better not remain for the rest of the performance, but go home.

Prehistoric Dentistry.

George Byron Gordon, the explorer, contributes an article on "The Mysterious City of Honduras" to the January Century. The article gives an account of recent discoveries at Copan. Mr. Gordon says:

"No regular burying place has yet been found at Copan, but a number of isolated tombs have been explored. The location of these was strange and unexpected — beneath the pavement of courtyards and under the foundations of houses. They consist of small chambers of very excellent masonry, roofed sometimes by means of the horizontal arch and sometimes by means of slabs of stone resting on the top of the vertical walls. In these tombs one, and sometimes two interments had been made. The bodies had been laid at full length upon the floor. The cerements had long since moulded away, and the skeletons themselves were in a crumbling condition and give little knowledge of the physical characteristics of the people; but one fact of surpassing interest came to light concerning their private lives, namely, the custom of adorning the front teeth with gems inlaid in the enamel, and by filling. Although not all of the sets found have been treated in this way, there are enough to show that the practice was general, at least among the upper classes; for all the tombs opened, from their associations with prominent houses, seemed to have belonged to people of rank and fortune. The stone used in the inlaying was a bright green jadeite. A circular cavity about one-sixteenth of an inch in diameter was drilled in the enamel of each of the two front teeth of the upper row, and inlaid with a little disk of jadeite cut to a perfect fit, and secured by means of a bright red cement."

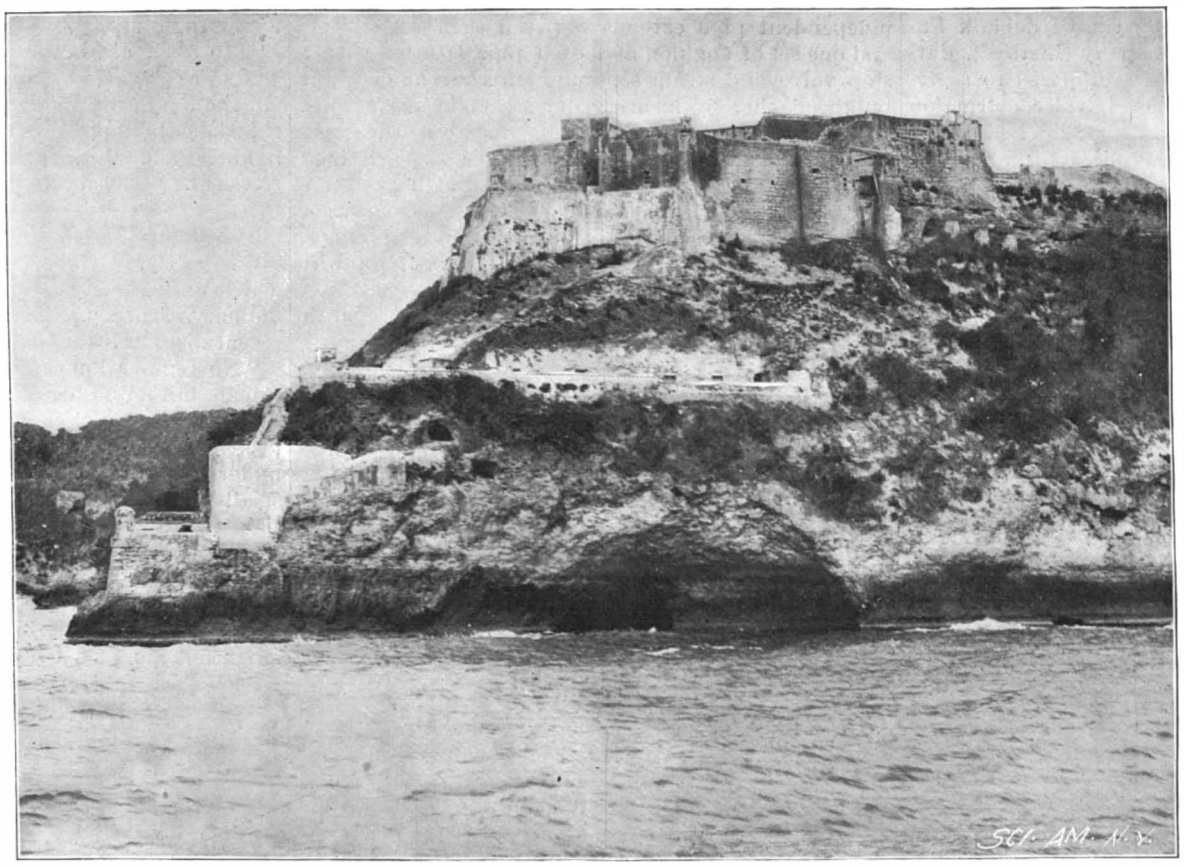
The Current Supplement.

The current SUPPLEMENT, No. 1172, contains a number of articles of great interest. The subject of the front page engravings are the guns made by Messrs. Vickers' Sons & Maxim. They are regarded as a very important type of modern English guns; 3-inch, 6-inch and 12-inch guns are illustrated. "Three-Colored Photographic Printing" is an article by Captain W. De W. Abney. Several novel types of acetylene gas generators are also shown. "Patents" is the subject of a paper by James W. See, which will be presented at the Niagara Falls meeting of the American Society of Mechanical Engineers. "The Battle of Manila" is the subject of an illustrated article showing one of the Spanish cruisers destroyed by Admiral Dewey and also a portrait of Admiral Montojo. "Pests and Poisons Peculiar to Cuba and the Philippines" is an interesting article by Dr. Archie Stockwell. "The Development of Central Stations" is an interesting address by Mr. Samuel Insull, the first installment of which is published in the current SUPPLEMENT.

© 1898 SCIENTIFIC AMERICAN, INC.

SANTIAGO DE CUBA—ITS ENVIRONMENT AND DEFENSES.

Next to that of Rio de Janeiro, the bay of Santiago de Cuba is, admittedly, the most picturesque in the western hemisphere. In reality, the bay forms two harbors, an inner and an outer, both landlocked, and approached by a very contracted and more or less tortuous channel, beset with rocks and shoals. In fact, the entrance to the outer harbor is difficult to locate, and would be almost impossible but for peculiarities of topographical outline and the fortifications that loom up against the hillsides. Santiago City, generally known as "Cuba" to the natives, lies at the further extremity of the inner bay on its right bank, consequently is not at all visible from the sea. Dirty and squalid for the most part, with ill-kept streets and dilapidated dwellings, it, nevertheless, is most attractive when viewed from the water front and at a distance; the yellow and blue houses literally rise from the water's edge, extending almost to the summit of a hill that, but for the dwarfing effect produced by the hazy blue peaks that encompass both valley and bay, would be termed a mountain. Indeed, the shores of the harbor are almost uniformly high and rugged, being merely the foothills and spurs of the Sierras.



ENTRANCE TO SANTIAGO DE CUBA'S MORRO CASTLE.

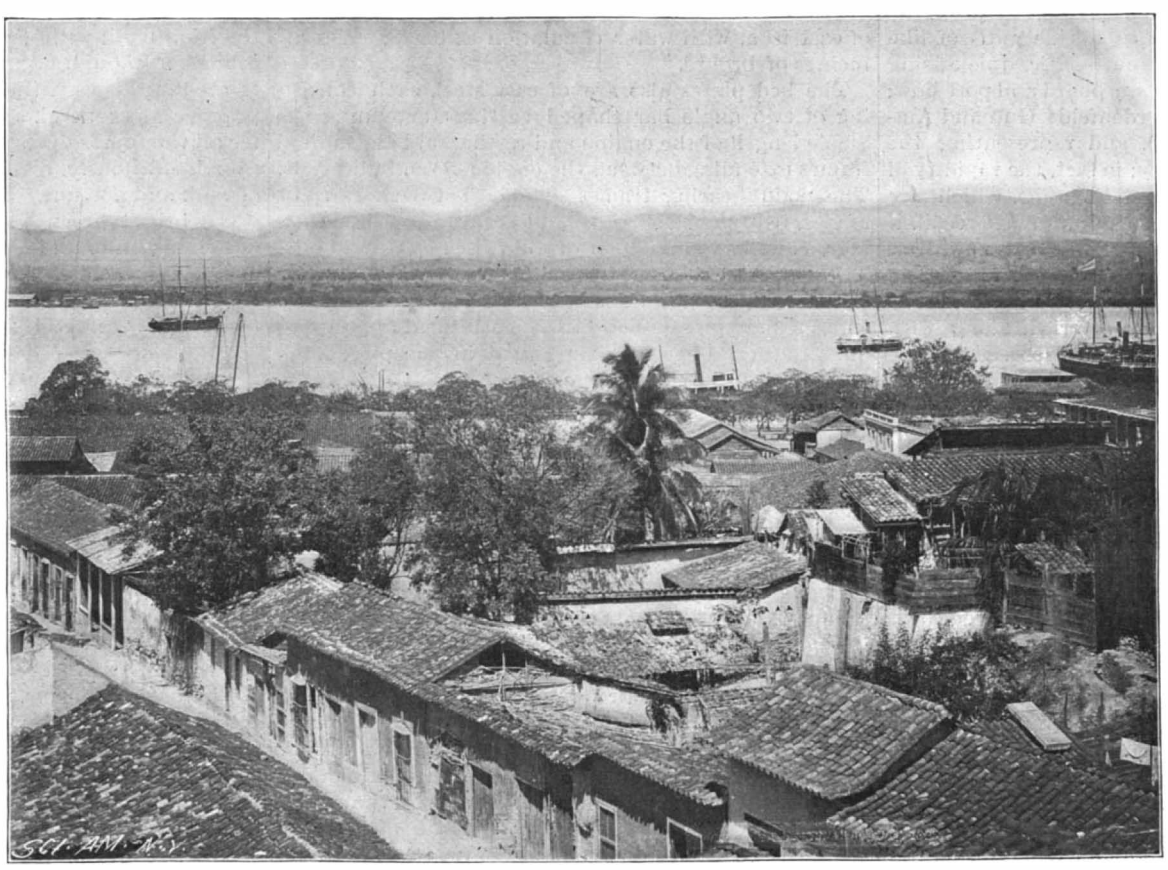
As a military and naval station, Santiago dates from 1514, when Diego Velasquez here founded a settlement and erected rude defenses for its protection. Thus, after Baracoa, Santiago is the oldest city in Cuba, and for more than two centuries enjoyed the distinction of being the capital of the island. In 1553 it was raided by the French and the fortifications in part destroyed. Ten years later a new series of defenses were undertaken, that in 1663–65 were replaced by the obsolete brick, stone and mortar structures now known as Morro Castle, and Estrella, Punta Gorda and Santa Catalina batteries. Of later date are batteries Aquadores and Blanca—the one an outlying defense to Morro, the latter occupying the place of the ancient artillery barracks just below the city—and the fortress of La Zocapa (or Socapa). Of still later date are water batteries on Isla de Smith, where the lower bay debouches into the narrow gut that connects it with the Caribbean Sea.

Morro, which is practically a duplicate, though on a slightly reduced scale, of the castle of the same name that guards the entrance to Havana, is perched high upon the cliff that at the right hand entrance of the harbor forms Morillo Point. Its ancient crumbling look and weather-beaten and discolored walls cause it to have the appearance of being ready to topple into the waves below; but for all, it is stronger and more defensible than its exterior would indicate, and the least salient portions lie beneath the masonry, having been excavated from solid rock. It will be recalled this structure once held the cells, offices and torture chambers of the Inquisition at the time when the "Holy Office" assumed to be arbiter of the destinies of all Spanish America. How far the Morro and its sister and outlying fortifications have been strengthened in order to meet the exigencies of modern warfare, and specially of the present conflict, is chiefly a matter of conjecture, and it is not safe to rely too much upon the indolent habits and procrastinating traits of the Hispano-Latin race.

Diagonally across the outer entrance of the harbor, to the west of Morro, and exactly opposite to the fortress of Santa Catalina on Cañones Point, stands the castle of La Zocapa. Here is the narrowest part of the channel, there not being more than 120 yards between the opposing shores. By a glance at the harbor plan, as published in the SCIENTIFIC AMERICAN of last week, it is possible to more fully realize the nature of the defenses of Santiago, remembering also that the natural topography of the region constitutes the strongest portion thereof, being such as to defy any improvement at the hands of man beyond fortifications and armament. The hostile vessel that essays Santiago Harbor is not only subjected to the fire of Morro and the water batteries below and behind to the east of this castle, but must likewise run the gauntlet of the Estrella, Santa Catalina and Zocapa; further, from the moment she is well inside Morillo Point she is subjected to an enfilading fire from Punta Gorda, an ordeal that is supplemented by a like fire from Isla de Smith as soon as the narrowest part of the channel is reached. At present this gut is additionally defended by the Spanish warships, Admiral Cervera having manifestly taken an advantageous position with this view. Presuming, however, all these obstructions and dangers are safely encountered and passed, to reach the city there still remains to be forced the second narrow channel, only about double the width of that guarded by Morro and Zocapa, et al., in order to enter the upper bay. Guarding the upper end of this channel is Rat Island (Isla de Ratones), now believed to be well defended by modern earthworks; and the battery on Punta Gorda has again to be considered, for if it has not been completely silenced, it is still capable of delivering an enfilading fire, and over the stern, instead of over the bow as before, of the foe. Again, certain charts indicate that in the vicinity of Rat Island the only navigable channel in certain spots shoals to 24 feet, which is prohibitive to the passage of battleships and the heavier class of cruisers, which require 26 feet.

Thus Santiago is eminently fitted by nature to be a western Gibraltar. Properly fortified and defended, the harbor could defy any attack from the seaward; and to the landward the rugged characters of the hills and mountains are such as to offer almost unparalleled advantages for either offensive or defensive operations. But since the early history of the province of Santiago, no measures have ever been taken to defend its capital city and chief seaport from the rear, except those of temporary and flimsy character that have been necessitated by the raids of insurgents.

In the light of the foregoing, the feat of Lieut. Hobson, in blockading the lower bay of Santiago, by sinking the collier "Merrimac" in the narrowest part of the channel, between Santa Catalina and La Zocapa, acquires new interest and further evidences the act was of a more daring and difficult nature than has generally been imagined. It is evident the strongest battleships could hardly hope to escape scathless under the fire of three fortresses—with all the advantages of elevation—and as many batteries, to say nothing of the Spanish fleet, not even if all the guns employed by the foe are of an obsolete type and comparatively deficient penetration. That the "Merrimac" and her volunteer crew suffered so little from the batteries must be ascribed, first, to surprise, and, second, to the distraction afforded by the fire of the United States squadron. To surely and certainly perform the task set demanded a cool head, insouciance to surroundings, and dogged persistence, since the enterprise was of the nature of a naval forlorn hope. The results to the country in practically, and for the present, at least, disposing of the Spanish fleet as regards future offensive operations in western waters, are incalculable.



THE BAY AND CITY OF SANTIAGO DE CUBA.

The Cavalry Horse.

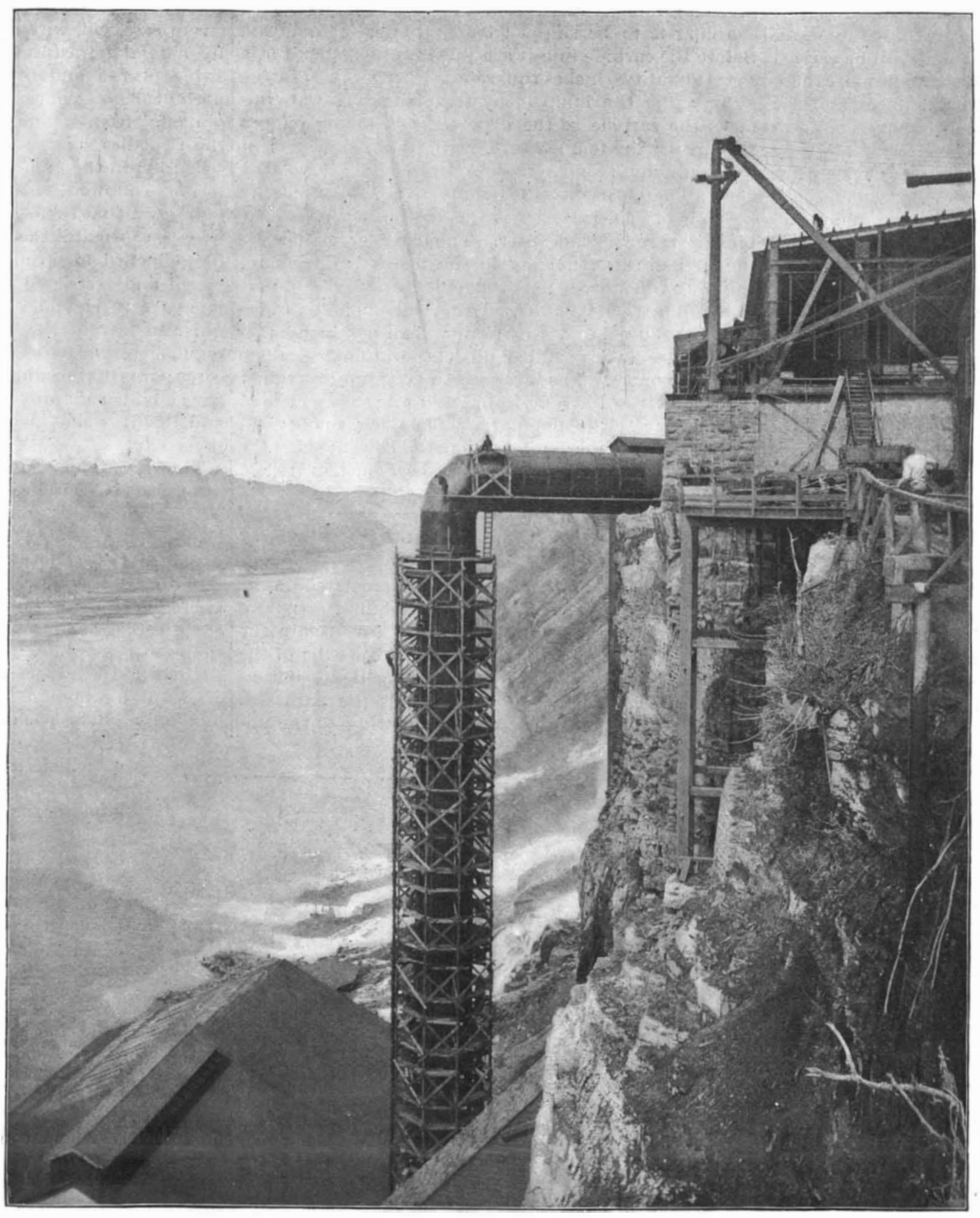
The army regulations prescribe the kind of horses desired for cavalry as follows: "The cavalry horse must be sound and well bred, gentle under the saddle, free from vicious habits, with free and prompt action at the walk, trot and gallop, without blemish or defect, of a kind disposition, with easy mouth and gait and otherwise to conform to the following description: A gelding of uniform and hardy color; in good condition; from 15 1-4 to 16 hands high; weight not less than 950 nor more than 1,150 pounds; from four to eight years old; head and ears small; forehead broad; eyes large and prominent; vision perfect in every respect; shoulders long and sloping well back; chest full, broad and deep; forelegs straight, and standing well under; barrel large and increasing from girth toward flank; withers elevated, back short and straight; loins and haunches broad and muscular; hocks well bent and under the horse; pasterns slanting and feet small and sound."

THE average walking pace of a healthy man or woman is said to be seventy-five steps a minute.

© 1898 SCIENTIFIC AMERICAN, INC.

A GREAT POWER HOUSE AT NIAGARA.

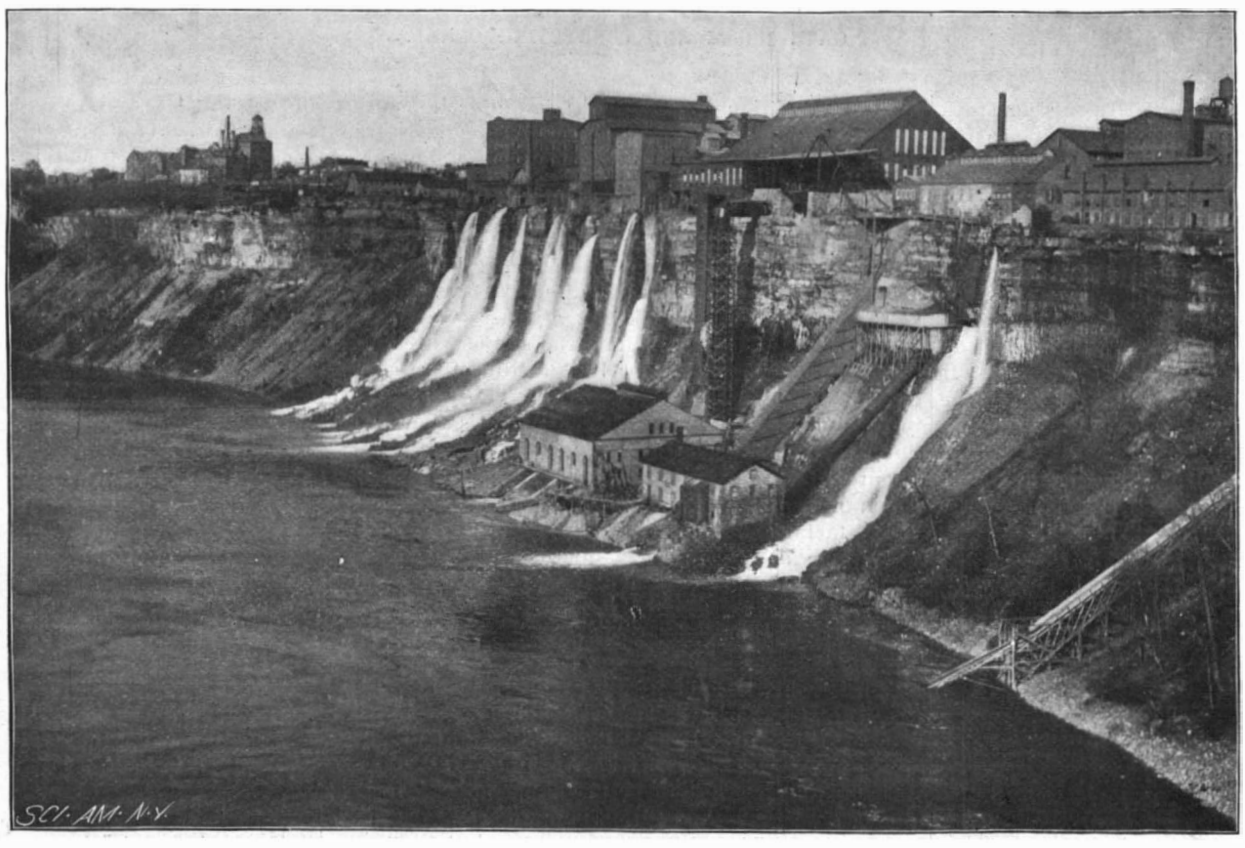
The canal of the Niagara Falls Hydraulic Power and Manufacturing Company is 4,400 feet long. For the past six years this company has expended a large amount of money in enlarging it. Their right to take water from the upper Niagara has been recognized by the State legislature to the extent that they may develop many thousand horse power. The present width of the canal at its entrance is 250 feet. In 400 feet the width narrows down to 70 feet, and at this width it continues to the basin, which is located about 300 feet back from the edge of the high bank, with which it runs parallel. The basin is about 400 feet long and 70 feet wide. The company own a right of way 100 feet wide all along the length of their canal, so that they can still further increase its width 30 feet at their desire. For 40 feet of the present width of the canal the channel is 14 feet deep, and for the remaining 30 feet it is 8 feet deep. In constructing the 14-foot channel it was run along the north side of the waterway for a portion of the length of the canal, and on the south side for the remaining distance, a course adopted, no doubt, in order that buildings standing close to the canal might be avoided until it is found necessary to still further widen the channel. The work of widening the canal is still in progress, in fact it seems to be the adopted policy of the company to proceed with this work until their waterway has attained its full width and depth. The company own their own outfit of drill boats, scows, dredges, tugs, etc., and unlike many companies, do their work by day labor instead of by contract, all being under the supervision of their chief of engineers, Wallace C. Johnson, M. Am. Soc. C. E. The excavated material is carried on scows to Port Day, at the entrance to the canal, and there deposited in huge mounds on the company's property. It is utilized in many ways, New York State through Superintendent Welch of the State Reservation, having found it most serviceable for filling purposes about the reservation, no charge being made to the State for it.



NEW PENSTOCK OF THE POWER HOUSE.

The power house at the water's edge is built of stone, much of it being quarried on the site. The walls are of the most substantial construction, while the roof is of the steel truss pattern. The original section of the building was completed in 1896, and there is installed in it four turbines made by James Leffel & Company, of Springfield, O., illustrated in the SCIENTIFIC AMERICAN for March 6, 1897, which operate eight generators, six of which supply power to the lower works of the Pittsburg Reduction Company, makers of aluminum, while the remaining two generators furnish power for the operation of the Niagara Falls and Lewiston Railway, better known, perhaps, as the "Great Gorge Route," shown in the SCIENTIFIC AMERICAN for March 28, 1896. So satisfactory was this original installation that the company immediately began the erection of an addition to the building. This addition is now completed, and the dimensions of the power house now are 100 feet by 120 feet, with ample room for still further enlargements. It is the intention of the company to place five wheels of 2,500 horse power each in the extension to the power house, and the first has been installed. It was made by R. D. Wood & Company, of Philadelphia, and in design slightly resembles the water wheels in the original section, but its construction is different. It is known as the Jonval-Geyelin improved wheel, and takes the water at the bottom through a 60-inch valve in the penstock. The water flows upward and is admitted to the guide wheels by a gate and then to the runners. From the sides project discharge pipes laterally and then downwardly, to which draught tubes 22 feet 8 inches long are attached, thus utilizing, in part, the atmospheric pressure. The heads of the casing are of cast iron, 1¾ inches thick with 2½ by 6-inch ribs at the bottom. Four 2¾-inch rods extend through the casing to stiffen it. The turbine wheels are made of bronze, and they are located in the draught tube casing, one on each side of the casing proper. The pair weigh 5,095 pounds. They are mounted upon a horizontal shaft, supported by a rigid bearing, with the flush bearings bolted to rigid bearings. The disk that forms part of the flush bearing is keyed to the shaft and adjusted by four heavy set screws, one on each end of the shaft to take up the thrust. The gate used is a ring gate. It revolves on a barrel, which is fastened to the guide wheels by bolts. A walking beam working over the main casing will operate the gate, which is connected to the beam by steel rods 2½ inches in diameter extending down through glands into the casing. Over the walking beam is an air cylinder about 36 inches high and having an inside diameter of 20½ inches. The Reynolds governor will be used. There are thirty-four buckets on the runners, having a total area of 140·25 square inches. On the guide wheel there are twenty buckets with a total area of 149·53 square inches. The wheel was installed under the supervision of E. H. Broome, representing R. D. Wood & Company.

Attached to one side of the wheel is a generator made by the General Electric Company for supplying current to the new chlorate of potash plant of the National Electrolytic Company located on the high bank above, adjoining the Cliff Paper Company's mill, and to the other side will be attached an alternating current dynamo designed to furnish current for the Buffalo and Niagara Falls Electric Light and Power Company. The first machine is in place and ready to run. It has been most carefully designed in order to enable it to cope with the severe service of electrolytic work, the process requiring practically continuous operation. The machine has 14 poles, and will make 257 revolutions per minute, giving an output of 5,000 amperes at 175 volts,



THE POWER HOUSE OF THE NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY.

RECENT DEVELOPMENTS OF THE WATER POWER OF NIAGARA FALLS.

© 1898 SCIENTIFIC AMERICAN, INC.

or a capacity of 875 kilowatts, which is nearly 1,200 horse power. It is direct connected to the water wheel. The current from this machine will be carried to the chlorate of potash works on aluminum cables, the lower part of which will be in bar form, and the upper in the form of cables well insulated. They will be the first of the kind put in practical service, but the company have great confidence in their efficiency, as the current from the original section of the station is carried to the aluminum works over aluminum cables having 500 strands, and which have been found to give good service.

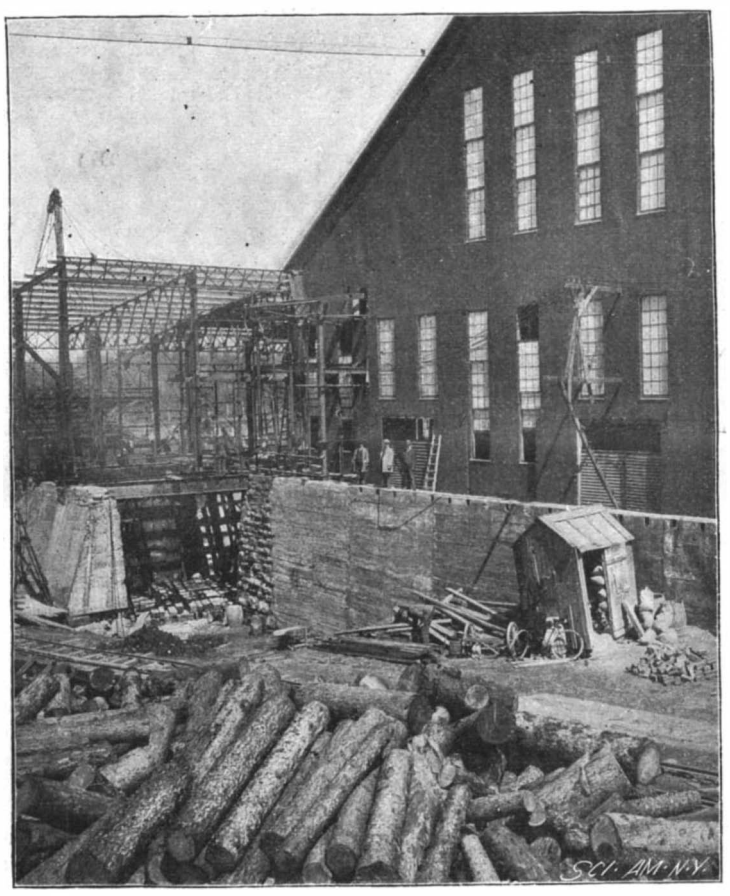
The dynamo for the Buffalo and Niagara Falls Electric Light and Power Company will be of 700 kilowatts output capacity at 2,200 volts pressure. It is to be operated at 250 revolutions per minute and at 125 cycles per second. It is being made by the Walker Company, of Cleveland, O. In connection with it there will be installed a continuous current exciter of sufficient current capacity to supply current to the fields of the dynamo to permit of its producing 1,100 kilowatts at standard voltage for a short time.

The water supply for this power station passes from the canal basin through a connecting canal about 16 feet wide, 20 feet deep and 300 feet long, to a forebay located on the edge of the high bank and running parallel to it. The length of the forebay is about 200 feet, and it is 30 feet wide by 22 feet deep.

The walls of the original section were built of stone, but in the recent extension concrete has entered largely into its construction, some of the walls being faced with stone. A second connecting canal is being built between the forebay and the canal basin, the walls being entirely of concrete. Where this canal passes beneath railroad tracks, it is to be made watertight.

The penstock of the original installation is 8 feet in diameter, the steel from which it is made varying from $\frac{5}{16}$ of an inch to $\frac{15}{16}$ in thickness. Leaving the penstock it extends horizontally 25 feet, then descends in a vertical direction 135 feet, and then at an angle of 45° to the power house. It runs under the power house floor for about 70 feet, being suspended in the tail race on iron supports. In erecting the penstock for the new installation several changes have been made. The new penstock is about 11 feet in diameter. It leaves the forebay with an elliptical bell mouth about 20 by 11 feet. It runs out horizontally supported by two steel beams for a distance of 60 feet and then drops vertically nearly 200 feet to the power house. For about 50 feet of its length under the power house floor it is 13 feet in diameter. After passing one or two wheels its diameter is reduced until it is 7 feet in diameter, beyond which point it tapers off into a cone 18 inches in diameter to form a head, finally ending in an air chamber 15 feet high by 4 feet in diameter. Owing to the size of the elbow, considerable trouble was experienced in getting it to the desired point at the falls, as the passageways between some of the mills were too low to allow its passage on cars. The steel used in its construction varies from $\frac{5}{16}$ to $1\frac{1}{8}$ inches in thickness. The new tail race under the power house floor is 22 feet wide and 30 feet deep, being slightly larger than the tail race under the original section of the building. Its construction is most substantial, of ashlar masonry. In this penstock the new penstock is supported by a series of posts and beams, made by the Variety Iron Works, of Cleveland, O., all parts of which Chief Engineer Johnson has had made adjustable by keys. The water discharged from the wheels has but a few feet to go to reach the lower river. Standing, as does the penstock, out from the cliff in column form, it presents a most imposing appearance and attracts much attention.

The gate house is located over the forebay. It is an iron frame structure covered with corrugated iron. It is a thoroughly fireproof structure, and stands in the rear of the lower works of the Pittsburg Reduction Company. Here are located the appliances for opening and closing the gates which allow the flow of water into the penstocks. Before the water passes into the penstocks it goes through racks which screen out all floating substances likely to endanger the wheels. The apparatus in the new section of this building will be very similar to that of the original installation, an improvement being made in waste gate appliances so as to avoid all trouble from floating ice.



GATE HOUSE AND CONNECTING CANAL.

Protecting Carbide against Moisture.

Carbide is packed for shipment in sealed tin cases, protected externally by wooden ones to prevent denting or piercing during handling or shipment, says The Progressive Age. As these cases cost above $15 per ton of carbide, they add materially to the price of this material. To overcome this expense and trouble, John M. Bulkley, of Detroit, has devised a method of coating the lumps of carbide with a waterproof material which prevents water or moisture from attacking the carbide, enabling it to be shipped loose, in bulk or in boxes. Before the carbide lumps are put into the generator, a space about two inches square is freed from this coating by breaking the lump or by scraping. The water attacks the carbide at the exposed spot, giving off gas and raising the temperature, the latter being sufficient to gradually remove the waterproof coating. The generation of gas is thus said to go on gradually instead of violently, as is the case when clear carbide is thrown into water. The inventor claims for the method: (1) Economy in the method of packing, shipping and storage; (2) convenience and cleanliness in handling; (3) immunity from accidents liable to occur through contact with water when not in use; (4) freedom from odor; and (5) no deterioration and waste when in storage. The idea seems a good one; certainly the end striven for is desirable and one that will tend to make acetylene popular by removing some valid objections. As to whether the method proposed is the most satisfactory, it remains to be demonstrated in practice.

The Slaughter House in Relation to Disease.

The growing danger of slaughter houses as a factor in spreading disease is at last being appreciated in its true bearings, says The Medical Record, and steps are being everywhere taken thoroughly to investigate the matter and to correct as far as possible the evils of the present system. There is much to be done, but as soon as the general public understands the nature of the perils to which it is subjected, owing to the unsanitary conditions under which slaughter houses are generally maintained, just so soon will they insist that remedial measures be taken. The most effective way to impress people with a sense of their danger is by pointing out to them that these unsanitary conditions are one of its sources, and to prove to them that, unless radical remedies be put into force, infectious diseases may increase to an almost unlimited extent.

Ch. Wardell Stiles, Ph.D., in a paper published in 1896, presents in a clear manner the subject of country slaughter houses as a factor in spreading disease. In the course of his remarks he says: "The first matter to notice in connection with this subject is that every slaughter house is, from the very nature of things, a center of disease, and naturally the poorer the condition of the premises, the more dangerous they are. These facts will appear clear if one considers what takes place at one of these houses. Even if only a few animals are slaughtered each week, the total number may amount to several hundreds during the year. Some of the animals are surely diseased. At least one of the hogs has trichinosis, and when the offal of this trichinous hog if fed to hogs which are raised upon the grounds, the latter cannot escape infection with trichinæ. But that is not all. The slaughter houses are often overrun with rats; the rats feed on the offal, and when feeding on the offal of a trichinous hog they likewise cannot escape infection with trichinæ. Rats act as direct transmitters of trichinosis to hogs." Dr. Stiles gives many more instructive details, but which we have not the space to quote. He summarizes thus: "Every slaughter house is a center of disease for the surrounding country, spreading trichinosis, echinococcus disease, gid, wireworm, and other troubles caused by animal parasites, and tuberculosis, hog cholera, swine plague and other bacterial diseases. The important factors concerned in spreading these diseases are offal feeding, drainage, rats and dogs." Two of the remedies suggested are as follows: "First, by a reduction in the number of premises on which slaughtering is allowed, on which account it is urged as all-important that there be a segregation of the slaughter houses, so that all the butchers of any given town will be compelled to do all their killing in a common, inclosed and restricted area. In abandoning slaughter houses care should be taken to destroy the rats, in order to prevent the spread of infection. Second, by regulating the factors concerned in spreading the diseases: (a) Offal feeding should be abolished; (b) drainage should be improved; (c) rats should be destroyed; and (d) dogs should be excluded from the slaughter houses."

This question of slaughter houses is attracting much attention in Europe, though chiefly in connection with tuberculosis, and some of the countries there have adopted stringent regulations controlling their management. The system in vogue in Denmark is said to be the most perfect. In Copenhagen every animal is after slaughter branded upon various parts of the carcass, and the brand is exposed in the butchers' shops to the public, which, in consequence, recognizes that the meat has been passed by the official inspectors as fit for human food. In England the question has only lately been seriously taken up. A royal commission has been appointed, members of which are at the present time visiting some of the principal towns in the kingdom for the purpose of collecting evidence. In France carcasses are seized when there are any visible signs of tuberculosis.

From abattoir statistics it is shown that in Berlin 12 per cent of the cattle slaughtered are tuberculous; in Dresden, 14·4 per cent; in Upper Silesia, 9·5 per cent; in Durham, 18·7 per cent; and in Mid-Lothian (a district in Scotland in which Edinburgh is located), 20 per cent. Of those slaughtered in London, 25 per cent are diseased, and in New York, about 20 per cent. There can be no room for doubt that the sooner the task of putting all slaughter houses into a proper sanitary state is effectively carried out, the better will it be for the public health.

Fever in Plants.

A phenomenon in wounded plants that seems to correspond exactly to what we should call fever in animals has been discovered in England by H. M. Richards. His experiments, which are described by him in The Annals of Botany, are thus epitomized in a note in Natural Science: "He finds that accompanying the increased rate of respiration is an increase in the temperature of the parts affected. A kind of fever supervenes, and as in the case of respiration, the disturbance runs a definite course, and attains its maximum some twenty-four hours after injury. It is interesting to note that the attempt to rally from an injury is accompanied by somewhat the same symptoms, increased rate of respiration and evolution of heat in plants as in animals. Owing to the nature of the case, the reaction is less obvious in the former than in the latter, and a delicate thermoelectric element was required to appreciate the rise in temperature; but, compared with the ordinary temperature of plants in relation to the surrounding medium, the rise after injury is 'as great, if not greater than in animals.' The maximum in all the plants investigated was between two and three times the ordinary excess above the surrounding air. Potatoes proved the most satisfactory objects for experiment, and it was found that in massive tissues (such as potatoes or radishes afford) the effect of injury was local, whereas in the case of leaves (e. g., onion bulbs) much greater extent of tissue was sympathetically affected."

From experiments on rabbits, Dr. T. Oliver concludes that risk of death from asphyxia after inhaling a mixture of air and acetylene is not so great as from a similar mixture of air and coal gas. The time taken to produce toxic effects is longer in the case of acetylene, and the symptoms are free from the nervous or respiratory excitement seen with other narcotic vapors. Provided asphyxia has not gone too far, recovery is rapid after exposure to fresh air. The subject is receiving further investigation.—British Medical Journal.

A drop hammer just erected in the Billings & Spencer works, in Hartford Conn., is said to be the largest in the world. The drop weighs 3,000 lb. and the anvil 90,000 lb.

© 1898 SCIENTIFIC AMERICAN, INC.

VOLCANOES AND EARTHQUAKES IN THE PHILIPPINES.

BY PROF. J. B. STEERE.

The Philippine Islands lie along the great belt of volcanic activity which extends from Japan to the Moluccas. The chain of living volcanoes enters the Philippine archipelago from Formosa, through the Bashees group, and, running the entire length of the great island of Luzon, bends to the west and enters the island of Negros at its northern end and, passing down this island, crosses to Mindanao, apparently through Siquijor or Fire Island. With several active volcanoes in the Bashees Islands and that of Cagua at the northeastern extremity of Luzon, the volcanic force seems to be exhausted until the vicinity of Manila is reached. One of the chief landmarks of the capital is the great cloud-capped cone of Mahayhay, standing off to the southeast. It appears to be now extinct, the last eruption occurring in 1730. It is over 7,000 feet high, but the crater has fallen in and the whole mountain is overgrown with luxuriant vegetation. Toward the top this consists, in great part, of tree ferns, with their trunks draped in mosses and overgrown with many species of smaller ferns.

In the province of Batangas and almost due south of Manila, at a distance of some 25 miles, is the active volcano of Taal. It stands in the middle of the lake of the same name. It is less than a thousand feet in height and looks like the summit of a great volcano which has sunk in the lake, and there are native traditions to this effect. At present its only sign of life is the column of white smoke which continually rises from its summit, but it was in active eruption in 1716 and again in 1754, when it threw out stones and hot ashes which destroyed the little villages on the shore of the lake. The clouds of ashes reached Manila, and the water of the lake is said to have boiled with the great heat.

At the southern end of Luzon are a number of volcanoes, but the most celebrated of these, both for its size and beauty and for the destructiveness of its eruptions, is El Mayon. It rises from the fertile plains of Albay to a height of over 8,000 feet, an almost perfect cone. The lower third of the mountain is densely covered with vegetation, which dwindles to bushes and coarse grasses above. The upper half of the cone is of bare sand and lava and other volcanic rocks. Mayon is constantly throwing out smoke and flames, and often streams of lava are seen flowing down the narrow ravines about the summit.

In 1766 there was a terrible eruption, destroying many villages upon the plains below, and in 1800 it was again in eruption, but with less destruction of life. In 1814 the most memorable of its eruptions occurred, perhaps appearing more destructive than the others, because there were eye witnesses to write its history. It was preceded and announced the night before by frequent earthquakes, concluding the next morning with a most terrible shock. After this the volcano was seen to immediately throw out an immense pyramidal cloud of smoke, black at its base, but of many colors in the middle, where the rays of the morning sun fell upon it, and ashy gray in its upper part. After another terrible earthquake shock and loud thunderings, the volcano began pouring out immense streams of lava. The atmosphere became suddenly dark and the flashes of lightning were incessant. Then, in the darkness, great red hot stones and hot ashes began falling. These reached for many miles about the base of the mountain and horses and cattle were killed in the fields. The villages were fired by the red hot stones falling and the people were crushed or suffocated as they attempted to escape. The rain of hot stones and ashes lasted for three hours and the darkness for five hours. Twelve thousand people were killed and many flourishing villages destroyed, and their sites buried and lost beneath the ashes. This was so deep in some places at the base of the mountain that trees were buried out of sight. The Spanish curate of one of the villages, Fr. Juan de la Torre, survived as if by miracle, and wrote the following account: "I was able to save my life by crawling under the trunk of a cocoanut tree, which was bent over, forming a little shelter. There I lay without my hat, and passing through a thousand dangers. I was accompanied under the tree by two wild boars, which had fled from the forest, two swine from the village, a crow with its wings stretched out, and a poor rat trying to protect its young ones."

MANILA—CHURCH OF SAN AUGUSTIN INJURED BY EARTHQUAKE OF 1872.

The eruptions of Mayon are said by the natives to be preceded by underground noises and mutterings like distant thunder. These are accompanied by trembling of the earth, while the birds and other animals flee from the mountain.

One of the landmarks of the central Philippines is the great volcano of Malaspina, or Kanloon, in the northern part of Negros. The level and fertile plains of western Negros, containing the most valuable sugar estates of the Philippines, are probably the product of former eruptions of this great mountain. Its base is surrounded by dense forests and but little is known of any recent eruptions. A native who had recently established an estate upon the east side of Malaspina, on the strait separating Negros from Zebu, told me that the mountain was continually shaking and groaning. Near the southern point of Negros is the ancient volcano of Dumoquete. There appear to be no accounts of its eruptions, but as we steamed along the coast we were struck with the appearance of immense ancient lava streams reaching from the summit of the mountain to the sea. Some of them looked like gigantic railway embankments, so even was their grade and so level their surface. They were too recent to have weathered into good soils and were covered for the most part with low trees and coarse grass. While stopping at the town of Dumoquete we heard of the existence of a lake called Danao, in the mountains, and we determined to visit it. We first followed one of the old lava streams up to the village of Santa Rosa, made up of a few families of Indians who were engaged in cultivating abaca, or Manila hemp. After leaving the village and climbing for six hours up the steep mountains and along knife-like ridges, we reached the lakes. There were two of these, each perhaps a quarter of a mile in diameter and lying in a valley surrounded by mountains so steep that we were in continual danger of slipping down into the water, which was over our heads a step from the shore. The lakes seemed to occupy an ancient crater, but the whole country was so thickly covered with timber that we could get but little idea of its configuration. The barometer showed a height of 3,500 feet.

The volcanoes of Mindanao are outside of the territory occupied by the Spanish and Christian Indians, and have been seldom visited. Mount Apo is said to reach a height of over 10,000 feet.

Earthquakes, the usual accompaniment of volcanic activity, are too common in the Philippines to be remarkable, unless they tumble one's house about his ears. The light, basketlike dwellings of the natives, perched upon posts, sway about like cradles during these strange movements of the earth, and are often thrown out of perpendicular, but are rarely destroyed.

The stone buildings of the Spanish, though usually built of light volcanic rock, or of coral, and with thick walls and low stories and projecting buttresses, to protect them from earthquakes, are frequently thrown down. Spanish Manila, the old walled town, the only city in the archipelago built of stone, has suffered most, and some of the streets are still blocked by the ruins of the great earthquake of 1880. In 1863 the city was nearly destroyed, and at frequent intervals since its foundation it has suffered loss of life and property.

In the provinces, buildings of stone are rarely found, those existing being generally the churches and conventos, or priests' houses. These have been built by the untrained natives and with no other architects than the priests themselves, but are strongly built and rarely fall. Several times, while being entertained by these hospitable priests, we have been startled by the cry of "Temblor!" when all would rush out of doors, to be out of the way of falling walls, and after a few minutes' waiting, would return to take up our dinner or conversation where we had left it.

VOLCANO OF MAYON HEIGHT 8,000 FEET.

A RAILROAD to extend entirely across northern Sweden and Norway, from the north end of the Gulf of Finland northwest to Ofoten, on the Atlantic, about 120 miles north of the Arctic circle, is proposed. The line will be about 300 miles long, and will, it is said, be further north than any part of the new railroad to Archangel.

© 1898 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Bicycle Appliances.

SADDLE.—Frederick C. Avery, Toledo, O. The object of this invention is to produce a saddle which will properly sustain the weight of the rider. The saddle consists of a seat portion, a cantle, a pommel-clip and an intermediate bearing plate connected to the seat portion. Means are provided for connecting the plate to the cantle to support the rider. The plate may also be yieldingly connected with the pommel clip. With this construction it is possible to adjust the tension on the saddle cover on the seat portion and horn portion independently. Any unnecessary weight on the horn portion causes that portion to move down, so that it can do no harm, the springs with which it is provided holding it in place.

TOOL-CASE.—Louis H. Knopping, New York city. This tool-case is formed in two halves, each half comprising a metallic frame consisting of a band or bar and forming the outline thereof to which a sheet of fabric is fastened. Hinges connect the two halves at their bottom edges. The case is fastened to the bicycle frame by a clamp consisting of a band of spring metal wound around the tube and having its ends bent inward at right angles to the body. One end is pierced to receive a clamping bolt. The other end is provided with a slot extending inward from the end, adapting it to slip over the clamping bolt. This fastening device is applicable not only to bicycles, but to all kinds of tubes.

BICYCLE-RAILWAY.—William F. Mangels, Brooklyn, N. Y. The purpose of the inventor in constructing his railway was to provide a means whereby unskilled persons can enjoy bicycle riding with the utmost safety. The railway is provided with a continuous track in which a duct is formed. An endless band of rigid material is mounted to travel in the duct. Upon the band posts are erected at intervals, frames being carried by the posts and connected with the bicycles traveling on the track. A brace arranged above the band connects the posts with one another. When the bicycles are actuated by the pedals, then they move forward carrying the band along, and since the bicycles are rigidly supported, no danger of falling off is incurred by unskilled persons.

Mechanical Devices.

CORN-PLANTER.—Samuel M. Wixcel, Marcus, Ia. The object of this invention is to provide a device to be used as a substitute for the check wire—namely, a belt contained in its entirety upon the machine and provided with driving devices operated by contact with the ground. A simple mechanism is also provided whereby the dropping apparatus of the seed-boxes is operated by the check-belt, and the markers are operated from the seed dropping mechanism. A marking device is also provided which will make a mark by which to draw and a mark by which to drop.

HAT-PRINTING MACHINE.—Thomas J. McCarthy, Orange Valley, N. J. In this machine for printing labels, firm names and ornamental designs in a hat, a frame is provided having guideways, another frame being mounted to slide on the guides. A lock holds the sliding frame in its lower position and a plunger in the sliding frame carries a printing die. Means are provided for normally retracting the plunger. A lever is mounted on the sliding frame and is connected to the plunger to project it upon an impression bed and the hat resting thereo... A gas-heating apparatus is situated in the plunger for heating the die, and an inking roller mounted upon a transversely movable slide engages the die in its upper position.

TICKET-HOLDER AND REGISTER.—Manuel Fortuño (deceased), Perry B. Turpin, Washington, D. C., administrator. The object of this combined ticket-holder and ticket-register is to prevent manipulation of the tickets by the conductor and to obviate the necessity of employing other means than the apparatus itself for registering the number of tickets sold. The apparatus comprises a reel for carrying the ticket strip, means for feeding a ticket of proper size and a registering device operatively connected with the feed device. The strip of tickets is forced out of the apparatus by means of a mechanism consisting of a plate on which the strip is supported, a sliding plate being provided with clamping arms to clamp the strip and carry it along. The sliding plate is impelled onward by means of a device consisting of a spring-controlled trigger outside of the apparatus, a shaft on which the trigger is mounted and a spring controlled lever mechanism mounted on the shaft and operatively connected to the trigger and sliding plate. The pulling of the trigger by the conductor actuates the sliding plate mechanism. The registering is done by a series of lettered rotary dial plates connected with the ticket operating mechanism.

BRUSHING OR COMBING MACHINE.—Edgar Cassanova, New Orleans, La. This machine, for combing the fringe of towels and for brushing the nap of blankets, comprises a casing in which a rotary brush-carrier is mounted. A series of brushes are fixed to the carrier and a transversely curved bed-plate is located in an opening in front of the casing. A holder-bar above the bed plate holds the fringe in place, so that the brushes will move through the fringe, which hangs free over the bed-plate. An endless belt movable below the brush carrier receives whatever lint may be brushed from the fringe and deposits it upon an upper stretch of endless belt which drops the lint in a suitable place. The brush-carrier may be rotated by any desired means. In brushing the nap of a blanket, the motion of the brushes and endless belts is reversed. The blanket is fed between the upper and lower belts, and is carried forward around a roller and along with the upper stretch of belt. As it passes underneath the brushes the nap is brushed and raised.

APPARATUS FOR COPYING, REGISTERING, CHECKING AND ADDING.—Jules Frydmane, Paris, France. According to this invention a board adapted to be inserted in the machine is employed in conjunction with the apparatus. The board carries a pad on which figures may be inscribed and a series of pivoted projections or plates bearing numerals and other indications. These plates, when in a predetermined position, are adapted to engage various parts of the machine upon the insertion of the board, and thus the machine will be operated according to the position of the plates.

MECHANICAL MOVEMENT.—Edward C. Riddle, Browning, Mo. This invention provides for a mechanical movement designed to convert reciprocating into rotary motion and the contrary. The invention comprises two racks, each consisting of two side bars having their inward or opposed surfaces toothed, and at such distance apart as to permit a pinion to engage the teeth of one side without touching the teeth upon the other side. Various constructions are provided by which the racks are caused to reciprocate by the revolution of the pinion or by which the pinion is caused to rotate by opposite reciprocations of the racks.

Miscellaneous Inventions.

FOUNTAIN-PEN.—John Weeks, Brooklyn, N. Y. In this fountain-pen the barrel is provided with a plunger moving longitudinally in the barrel and connected to a valve. The plunger, when moved in one direction, draws the ink from the nib, and when moved in the opposite direction forces the ink toward the nib, the valve controlling the supply of ink to the nib. The flow of ink is thus always under perfect control, and may be cut off to such an extent that the pen may be carried point up or point down without danger of leakage.

FIRE-EXTINGUISHER.—Abram H. Van Riper, Nutley, N. J. The object of this inventor is to provide a simple means whereby a chemical—usually a gas similar in chemical properties to carbon dioxide—may be mixed with a stream of running water, thus increasing the capacity of the apparatus. The fire-extinguisher comprises a mixing cylinder connected to a water inlet and outlet. A perforated conical disk is situated forward of the inlet. A cylinder for containing gas is also provided. A pipe leads from the gas-containing cylinder into the mixing cylinder and has a perforated disk-outlet discharging in the direction of the inlet of the first-named cylinder. Means are provided for mixing the gas and water in the first named cylinder. The invention is an improvement over most extinguishers in so far as the supply of extinguishing liquid is practically unlimited.

DISPLAY RACK.—Edward S. Robbins, Parker, S. Dak. This display rack is constructed in separable sections, one section being provided with a sleeve and the other section with skeleton tongues at angles to one another. A skeleton base constructed of diverging members connects the two tongues, either of the tongues being adapted to enter the sleeve. With this rack goods may be displayed in many positions to the best advantage.

GAS-STOVE.—Robert Pringle, London, England. This gas-stove has a casing comprising a roasting space which is provided with a door at the front. An air admission and heating chamber surrounds the remaining sides of the roasting space and is located at the lower part of the roasting space. The upper part of the heating chamber is offset or inwardly projecting, and is traversed by vertical flues leading from the space beneath to the roasting space above. Burners are situated in the space beneath the air heating chamber, but not directly beneath the flues. Air-inlets rise within the chamber and direct the incoming air against the flues. A depending baffle or curtain incloses a downcast passage opening to the combustion chamber at or below the level of the burners therein. An inner curtain depends within the line of the burners, so as to prevent the flames from being deflected inward and the products of combustion from passing up through the roasting chamber, while permitting the direct radiation of the heat from the flames to the roasting space.

STOVE.—Charles T. Litchfield and Joseph T. Baugher, Spokane, Wash. A combustion chamber is provided in this stove and on it is placed a casing having a closed top and draught-openings in its lower portion. A fire-box having its lower portion projecting into the combustion chamber is provided at its upper end with an extension. The fire-box and its extension form with the casing a heating space. A feeder or magazine projects through the top of the casing and extends into the upper end of the fire-box, the magazine forming, with the extension of the fire-box, an annular chamber through which the air from the heating-space passes to the fire-box. Stoves of this pattern have a strong down draught through the fuel, the coking surface being, moreover, formed in the fuel above the grate and beneath the fuel supply.

CARPET STRETCHER AND TACKER.—Cyril M. Jansky, Au Sable, Mich. This carpet stretcher is so constructed that, after having driven one tack, the tacking mechanism will be automatically moved to the position for driving the next tack, thus providing means for successively driving several tacks without moving the stretcher from its position. The carpet stretcher comprises a frame which may be secured to the floor, a stretching bar for engagement with the carpet and means for moving the stretching bar toward the frame. A tacking device is mounted on the frame and means are provided for imparting a step-by-step motion to the device longitudinally of the frame.

WIRE-FENCE TOOL.—Hugh W. Denison, Gebhart's, Pa. With the assistance of this tool it is possible to shrink wires when they have become slack and also to splice them when they are broken. The tool has a shank carrying a head and two angular lugs projecting from one face of the head and arranged in proximity to each other, the lugs having portions cut away at their corners to produce plane surfaces by which angles may be formed in the wire as the wire is crimped by the action of the tool. From the other face of the head a splicing lug projects having an undercut. A radial slot in the head leads to the splicing lug and receives the ends of the wire to be spliced, the ends being also engaged by the splicing lug. The tool is then turned so that the ends are twisted together and the splicing effected.

SCALE-WEIGHT.—John F. Brazleton, Butte, Mont. The purpose of this invention is to provide a weight which, when properly placed relative to the weight-bar, will not leave its position. A crotch or slot for the reception of a scale bar is provided in this scale-weight. The weight is made heavier at that side in which the crotch or slot is produced, the upper surface of the weight being inclined in the direction of the inner end of the slot or crotch.

HEEL-SPRING FOR BOOTS OR SHOES.—George E. Swan, Beaver Dam, Wis. When walking with a shoe to which this spring has been attached it is claimed that the muscles are relieved from the severe strain to which they are subjected under ordinary circumstances. The device is provided with a plate having an opening and adapted for attachment to a heel. A tread-block has its ends resting against the inside of the plate, the tread-block being of reduced thickness at its rear end. Its forward thickened end projects outward through the slot in the plate. A spring bears against and exerts a downward pressure on the block, and at its forward end presses against the front end of the tread-block, the rear end of the block being free to slide on the plate when the front end is pressed inwardly.

MUSICAL INSTRUMENT.—Benjamin C. Auten, Princeville, Ill. This musical instrument comprises a box and a sounding device within the box, actuated by devices controlled by keys. The keys and actuating devices are contained in a slidably mounted carriage. A top plate for the carriage has apertures through which the heads of the keys project, the apertures being arranged in rows indicating chords and scales. A shaft is journaled in bearings in the box and is provided with a gear wheel in mesh with a rack on the carriage. A ratchet wheel is mounted on the shaft. A spring-pressed pawl is attached to the box and engages the ratchet wheel. This instrument, it is claimed, can be played by persons of little or no musical knowledge.

READING ATTACHMENT FOR METERS.—Camilo L. Arques, San José, Cal. The reading attachment of this inventor comprises a plate having apertures for viewing the dials on the meters on which the attachment is to be used. Ring-shaped dials are mounted to turn on the plate concentric with the apertures, each movable dial being formed with numeral graduations from zero upward.

TWINE HOLDER.—Frank Bossong, Ellensburg, Wash. This twine holder is designed for use in mercantile establishments and is in general characterized by a take-up rod yieldingly suspended in proximity to a twine support or receptacle, so that the twine is always lifted out of the way when not in use and is at the same time held in position to be readily grasped when necessary. In use the rod is pulled down, and when the cord is released it springs up. The holder is mounted on a vertically adjustable carriage-plate, the side edges of which are turned rearwardly and inwardly to embrace a track-plate secured rigidly to a wall. A locking device retains the carriage-plate in any desired position.

CAPONIZER.—Andrew M. Duncan, Allerton, Iowa. This caponizer comprises a handle and a bowl or spoon-shaped end having a slot for the reception of the cord of the organs, a wire loop adapted to be contracted in close proximity to the bowl or spoon-shaped end to effect the operation and means for contracting the wire.

Designs.

LAMP-BODY.—William A. Rayment, Taunton, Mass. In this design a globular bowl is lined to simulate the appearance of a golf-ball and is supported by a series of golf-sticks, whose heads rest upon a base and whose shafts are crossed beneath the bowl. A flag and balls are produced in relief on the base and a depression is formed to simulate a golf-hole.

TIP FOR TOOL HANDLES.—John H. Hamlin, Salt Lake City, Utah. The body of the tool in this design is chambered and its closed end is convex. Upon the convex surface a tapering projection appears. One side-edge of the body is provided with a projecting head surface, a side of which is formed by a portion of a curved surface. In the opposite side-edge of the body an undercut recess is formed adjacent to the edge of the convex surface, which surface above the recess resembles a claw.

GRASS AND WEED CUTTER.—Jesse K. Painter, Julesburg, Col. The essential feature of this design consists of a flat blade whose edges are beveled at the upper surface. In outline the blade is provided with a rear edge formed upon the lines of a compound curve, the convex portion being at the center and the concave portions adjacent to the side edges of the blade. The sides are each formed with a short, straight surface. These straight surfaces meet converging surfaces, the latter forming at their connection a point at the front center of the blade.

KITCHEN CABINET.—Samuel Sanders, Leavenworth, Kan. The principal features of this design consist in a base and a casing rising from the rear portion of the base. The front edges of the sides of the casing are curved, the base having its front appearing with side posts and with ornamental legs connected by a vertical band. A horizontal top leads to a step-like top of the base, the top appearing in front of the lower portion of the casing.

PUZZLE-BLOCK.—Cortez Gatewood, Washington, D. C. This design comprises a rectangular game board upon which is a star having a broad tinted outline with depressions at the extreme points of the star and depressions at the junction of the points, the several depressions being wholly outside the star-lines.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

AMERICAN AGRICULTURIST YEAR BOOK AND ALMANAC FOR 1898. By Herbert Myrick. Springfield, Mass. 1897. Orange Judd Company. Pp. 665, xxxviii. Price 25 cents.

This year book is a treasure of statistics for the farm and home and office. It is a reference book on every subject pertaining to agriculture, industry, commerce and markets, economics and politics, household education, etc. It appears to be a very valuable book for the farmer, for whom it is primarily intended. It is remarkable what a large book can be sold for so small a sum.

THE DIFFERENTIAL. 1899. Published by the Junior Class of Case School of Applied Science. Cleveland, O. Pp. 147, xxxiii.

PRACTICAL STAIR BUILDING AND HANDRAILING. By the square section and falling line system. By W. H. Wood. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1894. Pp. 83. Price $4.25.

This work has been written to assist those who wish to acquire a knowledge of the most practical and systematic methods adapted for the execution of stair building and handrailing. The system of handrailing outlined is somewhat new, but the author has continuously put it to a practical test for more than five years, and he is convinced that it is only required to be known to be appreciated. In compiling this work the author has kept steadily in view the absolute necessity of treating most fully the elementary part. The book is illustrated with thirty-two plates.

THE DESIGNING OF CONE PULLEYS. A non-approximate, graphical solution for the problem of proportioning cone pulleys. With concise, practical rules. By Walter K. Palmer. Lawrence, Kansas. 1898. Pp. 35. Price 50 cents.

Probably no other minor operation of machine designing involves such a complex mathematical analysis as the apparently simple one of proportioning a pair of cone pulleys. The present pamphlet is intended to convey information useful in designing such pulleys.

WATERS WITHIN THE EARTH AND LAWS OF RAINFLOW. By W. S. Auchincloss, C.E. Philadelphia. 1897. Pp. 43.

ANIMAL FATS AND OILS. Their practical production, purification and uses for a great variety of purposes, their properties, falsification and examination. A handbook for manufacturers of oil and fat products, soap and candle makers, agriculturists, tanners. With 62 illustrations. By Louis Edgar Andés. Translated by Charles Salter. London: Scott, Greenwood & Company. New York: D. Van Nostrand Company. 1898. Pp. 240. Price $4.

The present work takes up the subject of animal fats and oils from the practical manufacturer's standpoint, and it contains illustrations and descriptions of the latest processes of producing and purifying a large number of oils for a great variety of purposes; as, in the case of vegetable fats and oils, considerable improvements have been introduced into the preparation of the animal products belonging to the same category. Great improvements have also been made in the preparation of bone, waste fat, fish oil, etc., all of which are included in the present work, which should be in the hands of all those who are interested in the fat industry.

ALGEBRA MADE EASY. By Edwin J. Houston and Arthur E. Kennelly. New York: American Technical Book Company, 45 Vesey Street. 1898. Pp. 101. Price 75 cents.

This little volume has been prepared by the authors for the purpose of elucidating the mathematical formulæ appearing in the pages of Prof. Silvanus Thompson's "Dynamo-Electric Machinery and Polyphase Electric Currents."

THE PROCESS YEAR BOOK FOR 1898. A review of the graphic arts. Edited by William Gamble. London: Penrose & Company. 1898. Pp. 132. Price $1.50.

The Process Year Book is always a welcome visitor, and we do not remember any of the former volumes in which there has been such a notable improvement in the quality of reproductions. The half tone work is superb and the splendid plates are printed on the finest quality of half tone paper, thus insuring the best possible results. The use of tints appears to be quite general in the highest class of work, and the Vandyke printing from the Swantype blocks is very noticeable. The three color blocks are also excellent. One of the finest photographs we have ever seen is the one showing the removal of the charge from a retort in a gas works, taken from a flashlight photograph at night. This is an ideal subject for the painter. Another notable engraving shows the shooting of a natural gas well. As usual, the text is made up of contributions by practical men of all countries.

PRAKTIKUM DER WISSENSCHAFTLICHEN PHOTOGRAPHIE. Dr. C. Kaiserling. 26 Bogen in Lex.-8°. Mit 193 Figuren und 4 Tafeln. Verlag von Gustav Schmidt (vorm. Robert Oppenheim). Paper $2.50, cloth $2.75.

The position occupied by Dr. Kaiserling as an assistant and lecturer on photography in the Royal Pathological Institute of Berlin has eminently fitted him to write a book on the practice of scientific photography, the need of which has been felt particularly by physicians and students of natural science. The work, as its title indicates, is, above all, practical, only the absolutely necessary theoretical foundations of photography having been retained. The technical methods recommended are those which have been tested by the author's long experience as a scientific photographer. Excellently treated are the difficult problems of microphotography, and of particular interest are the sections on radiography and photography in natural colors. The two hundred illustrations with which the work has been embellished contribute not a little to its general excellence.

© 1898 SCIENTIFIC AMERICAN, INC.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

"U. S." Metal Polish. Indianapolis. Samples free.

Gasoline Brazing Forge, Turner Brass Works, Chicago

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Handle & Spoke Mchy. Ober Lathe Co., Chagrin Falls, O.

FERRACUTE Machine Co., Bridgeton, N. J. Full line of Presses, Dies and other Sheet Metal Machinery.

Improved Bicycle Machinery of every description. The Garvin Machine Co., Spring and Varick Sts., N. Y.

Gasoline Engines and Launches. Free catalogue. Geo. H. Gere Yacht and Launch Works, Grand Rapids, Mich.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7452) P. J. McC. asks: Was the navy of the United States sixth in the list of navies on May 26, 1898? A. The navies of the world rank as follows: England, France, Russia, Italy, Germany, Japan and the United States. There is considerable room for doubt as to the relative position of the navies of the last three countries.

(7453) R. M. G. asks: How can I make a fountain that will deliver a thin sheet of water in the form of a bubble? A. If the bubble is to be hemispherical, discharge the water on the center of a thin metal disk, having sharp edges. The disk must be held in a horizontal position, and the water should not strike the disk with too much force. A wide, thin film of water is produced by discharging the water on a flat plate with a straight, sharp edge.

TO INVENTORS.

An experience of fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

JUNE 7, 1898,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid, making hydrochloric, Wylde & Kynaston.. 605,369
Air brake, W. H. Clowry.. 605,394
Air ship, A. Koehler.. 605,438
Alarm. See Burglar alarm. Door barricade alarm. Loom slack alarm.
Aluminum sulfid and reducing same to metallic state, producing, H. S. Blackmore.. 605,380
Aluminum sulfid, making, H. S. Blackmore.. 605,378
Anchor, stockless, G. H. Burrows.. 605,076
Applicator, C. P. Brown.. 605,386
Artillery field mount, W. H. Bevans.. 605,377
Auger, post, J. Evans.. 605,411
Automatic lever switch, J. F. Gaylord.. 605,313
Bag closure, A. L. Ross.. 605,343
Bag or pouch, W. F. Beasley.. 605,068
Baling press, P. K. Dederick.. 605,273
Barrel washer, G. Schock.. 605,138, 605,139
Barrels to stocks, detachably uniting, W. Mason.. 605,111
Basket making machine, Durham & Devine.. 605,408
Battery. See Water battery.
Battery plates, connector for storage, G. Hart.. 605,424
Bearing, roller, Susemihl & Torrey.. 605,147
Bed, P. B. Rooney.. 605,136
Bed, folding, R. C. Odell.. 605,126
Bedstead corner piece, F. Eagon.. 605,310
Bedsteads, reversible rail grip for, G. Brand.. 605,286
Bicycle, A. Johnston.. 605,182
Bicycle, C. F. Nilson.. 605,331
Bicycle, A. S. Weaver.. 605,365
Bicycle brake, C. M. Fobes.. 605,092
Bicycle bundle carrier, C. Rondell.. 605,188
Bicycle combination tool, E. W. Sweigard.. 605,453
Bicycle driving connection, H. W. Johnstone.. 605,183
Bicycle riders, pipe hanger and shield for, F. Skinner.. 605,142
Bicycle saddle, J. F. Twist.. 605,151
Bicycle stand, W. H. Howard.. 605,429
Bicycle steering head, automatic, A. C. Garcia.. 605,417
Bicycle support, J. H. Iler.. 605,433
Bicycle toe clip, H. W. Calvert.. 605,390
Bicycle wheel belt, W. F. Glidden.. 605,181
Bicycles, axleless sprocket for, J. P. Archdeacon. 605,214
Bicycles, etc., propelling means for, H. Cavicchi.. 605,392
Billiard cue, F. Leu.. 605,253
Bismuth methylene digallate and making it, E. Durkopf.. 605,246
Boiler, B. P. Emery.. 605,410
Boiler brace, A. F. Huston.. 605,432
Boiler furnace, Harmel & Galloway.. 605,261
Boiler incrustations, composition for removing, G. Linde.. 605,320
Bookbinding, J. R. Wales.. 605,364
Boring conical holes, tool for, L. F. C. Rich.. 605,259
Bottle nipple, nursing, Clement & Wilkinson.. 605,161
Bottle, non-refillable, G. E. & C. F. Henry.. 605,227
Bottle washer, C. H. & H. B. Fischer.. 605,179, 605,180
Box. See Cigar box. Display box. Match box.
Box fastener, C. M. Cunningham.. 605,401
Brake. See Air brake. Bicycle brake. Wagon brake.
Bridge, suspension, Waddell & Hedrick.. 605,153
Brush, L. A. Lightenhome.. 605,230
Brush, H. E. Miller.. 605,185
Buckle, W. A. Mitchell.. 605,114
Bulkhead doors, hydraulic mechanism for closing, W. B. Cowles.. 605,399
Burglar alarm and lock, combined, C. R. Sabin.. 605,344
Burial apparatus, R. H. Thorne.. 605,360
Burner. See Hydrocarbon burner.
Button, N. D. Ingram.. 605,292
Button, I. G. Platt.. 605,130
Cabinet, exhibiting, A. Gartner.. 605,222
Calculating machine, G. B. Grant.. 605,288
Call box system, Salisbury & Dean.. 605,345
Can. See Key opening can.
Can cover, milk, E. E. Harvey.. 605,425
Can ending or heading machine, H. Schaake.. 605,189
Capstan, J. B. Sample.. 605,346
Car coupling, J. E. Cunningham.. 605,287
Car fender, G. C. Hutcheson.. 605,284
Car fifth wheel, railway, Perry & Mitchell.. 605,205
Car, railway, W. L. Austin.. 605,305
Car seat foot rest, W. M. Norcross.. 605,124
Car strap, F. W. Burke.. 605,075
Car wheel, F. E. Canda.. 605,391
Carriage, motor, H. R. Bird.. 605,243
Carriage step, W. F. Hopkins.. 605,428
Cartridge machine wad placing mechanism, G. M. Peters.. 605,258
Cartridge shell heading machine, W. B. Place.. 605,338
Cartridge shell heads, machine for assembling, W. B. Place.. 605,340
Cartridge shell heads, machine for priming or capping, W. B. Place.. 605,339
Case. See Ticket case.
Centrifugal machine, M. Davidsen.. 605,087
Chair. See Dental chair.
Chenille cutting machine, W. McCleary.. 605,118
Chopper. See Cotton chopper.
Christmas tree ornament, B. Wilmsen.. 605,158
Chuck, lathe, A. J. Johnson.. 605,166
Cigar box, E. F. Hamburg.. 605,421
Clamp. See Telescopic clamp.
Clasp, J. L. Carney.. 605,219
Cleaner. See Track cleaner.
Clip. See Bicycle toe clip.
Clock dial for indicators, etc., illuminated, R. R. Gareau.. 605,312
Clothes pin or clamp, L. B. Reeds.. 605,207
Coat, hunting, W. S. Carter.. 605,077
Combination lock, I. H. Cleveland.. 605,271
Composing machine, monoline, W. S. Scudder.. 605,141
Controller, T. Von Zweigbergk.. 605,304
Cork cutting machine, C. Noel.. 605,297
Cornish boiler, Thomassen & Krop.. 605,149
Corset shield, M. L. Perrottet.. 605,299
Cotton chopper and cultivator, J. J. Holland.. 605,426
Cotton fabrics, apparatus for applying finishing substances to, C. H. Jacob.. 605,434
Couch seat, J. B. Gardiner.. 605,095
Countersinker, C. Dumaw, Jr.. 605,407
Coupling. See Car coupling. Hammock support coupling. Hose coupling. Tire coupling.
Coupling closure, J. Muhr.. 605,323
Cream from milk, apparatus for separating, C. L. & F. G. Lee.. 605,252
Cultivator tooth seat, adjustable, J. D. Schofield. 605,140
Cutter. See Tobacco cutter. Tube cutter.
Cyclist's pouch, Deacon & Timpe.. 605,308
Dental bridgework, Davis & Townsend.. 605,403
Dental chair, M. C. Merker.. 605,255
Dental plate swaging apparatus, J. H. Gartrell.. 605,223
Dental plugger, F. S. Avil.. 605,171
Desk and seat, combined school, J. B. Burfoot.. 605,268
Diamond grinding and polishing machine, Stern & Cook.. 605,193
Digging or cultivating implement, land, T. A. & S. C. Darby.. 605,086
Dirt roller and pulverizer, combined, L. Chambers.. 605,160
Dish drainer, M. L. Perrottet.. 605,336
Display box, G. W. Frohlich.. 605,248
Display card, H. T. Smith.. 605,351
Display last, pneumatic, W. J. Thill.. 605,239
Display stand, G. H. Burnham.. 605,307
Displaying pictures, etc., device for, R. Sylvester.. 605,148
Door barricade alarm, G. D. Winters.. 605,366
Drainable pipe for tanks, T. J. Murfin.. 605,295
Drill. See Grain drill.
Drying frame for woolen garments, folding, H. Bristol.. 605,383
Dye and making same, black disazo, Kahn & Heidenreich.. 605,103
Dye, diphenylnaphthylmethane, O. Nastvogel.. 605,119
Egg carrier, C. Goetz.. 605,418
Electric selector system, T. C. Drake.. 605,309
Electric switch, C. C. Badeau.. 605,067
Electric transformer, Bellman & Rittenhouse.. 605,194
Engine. See Pumping engine. Rotary engine.
Engine cylinders, water jacket for, W. F. Davis.. 605,405
Engine igniter, explosive, O. Owens.. 605,333
Envelope opener, W. H. Fox.. 605,093
Eraser, B. B. Goldsmith.. 605,163
Exercising device, F. E. Spink.. 605,237
Fare indicating and registering apparatus for cabs, etc., F. W. G. Bruhn.. 605,442
Fare recorder, W. J. Fordney.. 605,247
Fence, F. Childers.. 605,393
Fence, D. D. Frisbie.. 605,094
Fence post, J. H. Sparks.. 605,355
Fencing tool, wire, J. R. Smith.. 605,352
Fender. See Car fender.
Filter, C. H. Loew.. 605,110
Filtering apparatus, S. Twitchell.. 605,152
Flower crimping machine, artificial, L. Ebert.. 605,409
Flue stopper, J. M. Padgett.. 605,128
Fodder compressor, J. B. Carter.. 605,220
Food, preparing liquid, W. Sellman.. 605,190
Formaldehyde generator, O. L. Affelder.. 605,372
Frame. See Drying frame.
Fruit, flowers, etc., cutter and holder for, W. W. Crockett.. 605,400
Fruit picker, L. S. Hagan.. 605,419
Fruit picker, Hudgins & Jones.. 605,461
Fruit press, A. H. Bales.. 605,267
Furnace. See Boiler furnace. Hot air furnace.
Furnace, A. Pillatt.. 605,206
Furnace, C. W. Trotter.. 605,240
Furnaces, electrical apparatus for charging, J. P. Eck.. 605,090
Furniture, adjustable, G. A. Bobrick.. 605,306
Game or puzzle, B. B. Goldsmith.. 605,164
Garment and hose support, combined, C. A. W. Lindsay.. 605,108
Garment hanger, T. G. Owen.. 605,332
Garment supporter, M. B. Hammond.. 605,225
Gas generating apparatus, acetylene, Scarth & Thornton.. 605,137
Gas generator, acetylene, J. H. Couper.. 605,397
Gas generator, acetylene, Couper & Bryan.. 605,398
Gas jet cutoff, L. Ramage.. 605,132
Gas regulator, A. Kuhne.. 605,168
Gas under high pressure, producing and storing, E. M. T. Boddam.. 605,217
Gate, H. B. Weston.. 605,455
Gear, reversing, J. H. Hare.. 605,226
Gear teeth, machine for forming, J. E. Gleason.. 605,249
Gearing, differential, D. Fyfe.. 605,416
Generator. See Formaldehyde generator. Gas generator.
Glass mould, H. L. Reinhardt.. 605,133
Governor, fluid motor, E. F. Williams.. 605,241
Grain drill, Montgomery & Berry.. 605,322
Grain separator J. F. Koch.. 605,437
Grain spout, A. D. Bellinger.. 605,375
Graining, J. J. Callow.. 605,244
Granulating disk, H. & G. Rose.. 605,452
Grappling hook, T. David.. 605,221
Gripping device, E. A. Thomforde.. 605,454
Gun carriage, W. H. Bevans.. 605,376
Gun mounting, disappearing, A. T. Dawson.. 605,459
Gun, pneumatic, E. M. T. Boddam.. 605,216
Hammock support coupling, Wright & Dell.. 605,367
Hanger. See Garment hanger.
Harmonica, C. L. Curtis.. 605,083
Harvester, corn, A. Neer.. 605,121
Harvester, corn, J. H. Newell.. 605,122
Harvesters, butt adjuster for self-binding, W. Butterfield.. 605,388
Hat body shaping apparatus, J. B. Buckman.. 605,073
Hat fastener, W. N. Murdock.. 605,116
Hay press, J. D. Coxwell.. 605,080
Heat or cold indicator, E. B. Petersen.. 605,129
Hinge, gate, J. R. Haldeman.. 605,420
Hinge washer, antifriction, H. Leppert.. 605,105
Hook. See Grappling hook, Whiffletree hook.
Hoop sawing machine, barrel, T. C. Seekel.. 605,349
Hose coupling, automatic, W. A. Sutfin.. 605,238
Hot air furnace, etc., T. G. Neal.. 605,329

(Continued on page 398)

Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

WOOD or METAL WORKERS without steam power can save *time* and *money* by using our **Foot and Hand Power Machinery**
SEND FOR CATALOGUES—
A—Wood-working Machinery.
B—Lathes, etc.
SENECA FALLS MFG. COMPANY,
695 Water St., Seneca Falls, N. Y.

AMERICAN PATENTS.—AN INTERESTING and valuable table showing the number of patents granted for the various subjects upon which petitions have been filed from the beginning down to December 31, 1894. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.

POWER & FOOT **LATHES.** SHAPERS, PLANERS, DRILLS, MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE.
SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

MACHINE DESIGN,
Mech. Drawing, Mech. and Electrical Engineering,
Taught at Your Home for $2 Per Month.
This pays for Text Books, Drawing Plates, and Instruction until you complete the course.
☞ *Write for free S. A. Circular.*
THE UNITED CORRESPONDENCE SCHOOLS,
F. W. Ewald, Gen. Mgr. 154-158 Fifth Ave., N. Y.

TOOLS Every kind of Tool for Steam, Gas, and Water Fitters. Every Tool has our personal guarantee. We have been the Leading Tool Manufacturers for Fifty Years . . .
WALWORTH MFG. CO.,
20 OLIVER STREET, BOSTON, MASS.

A Marvel in Machinery

for speed, precision, neatness and smoothness of work is the **RIVETT LATHE** with Cutter Milling and Gear Cutting Attachment. Now in use in all the best shops and adopted by all great universities.
☞ *Send for* 1898 *Catalogue.*
FANEUIL WATCH TOOL CO., Boston, Mass., U. S. A.

WORK SHOPS

of Wood and Metal Workers, without steam power, equipped with **BARNES' FOOT POWER MACHINERY** allow lower bids on jobs, and give greater profit on the work. Machines sent on trial if desired. *Catalog Free.*
W. F. & JOHN BARNES CO.
1999 RUBY ST., ROCKFORD, ILL.

HIGH GRADE WOODWORKING MACHINERY

Single Machines or Complete Equipments for Any Class of Work.
Your Correspondence is Solicited.
☞ Illustrated Matter and Prices on application.
J. A. FAY & CO.
10-30 John St., CINCINNATI, OHIO

The Queen Acme No. 5 Microscope
NEW MODEL AS PER CUT.

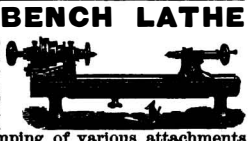
The Ideal Microscope for Amateur Research. Stands unequaled for precise and accurate adjustments and optical excellence. With objectives giving from 50 to 500 diameters, in case, **$35.00.**
Send for new Microscope Catalogue B. M.
QUEEN & CO., INC.
1011 Chestnut St., Philadelphia, Pa.

REVERSING STEAM TURBINE.—PARSON'S recently perfected turbine for boats. Illustrations showing details. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1158.** Price 10 cents, by mail, from this office, and from all newsdealers.

TRANSITS AND LEVELING INSTRUMENTS.
NICKEL PLATED POCKET LEVELS

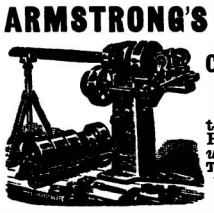
Sizes, 2½ and 3¾ inches. Prices, 40 and 50 cents.
For Book on the Level.
C. F. RICHARDSON & SON,
P. O. Box 977, ATHOL, MASS., U. S. A.

THE BEST BENCH LATHE



for precise and accurate work of all kinds is shown here in cut, and comprises Bed, Head Stock, Tail Stock, T Rest, Face Plate, Two Centers and Binder Bolt. Form of bed makes possible the clamping of various attachments without distorting the metal. Other special features that give general satisfaction wherever tried. For further and fuller particulars send for free descriptive booklet.
The Pratt & Whitney Co., Hartford, Conn.

ARMSTRONG'S PIPE THREADING
—AND—
CUTTING-OFF MACHINES
Both Hand and Power.
Sizes 1 to 6 inches.



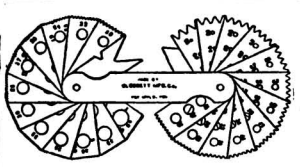
Water, Gas, and Steam Fitters' Tools. Hinged Pipe Vises. Pipe Cutters. *Stocks and Dies universally acknowledged to be* THE BEST. ☞ *Send for catalog.*
THE ARMSTRONG MFG. CO.
Bridgeport, Conn.

WILLIAMS'
SHAVING STICK
BACKED UP BY THE NATION.

Williams' Soaps sold everywhere, but sent by mail if your dealer does not supply you.
Williams' Shaving Stick, 25 cts.
Genuine Yankee Shaving Soap, 10 cts.
Luxury Shaving Tablet, 25 cts.
Swiss Violet Shaving Cream, 50 cts.
Jersey Cream (Toilet) Soap, 15 cts.
Williams' Shaving Soap (Barbers'), 6 Round Cakes, 1 lb., 40c. Exquisite also for toilet. Trial cake for 2c. stamp.
THE J. B. WILLIAMS CO.,
LONDON, 64 GREAT RUSSELL ST., W. C. GLASTONBURY, CONN. SYDNEY, 161 CLARENCE ST.

ACETYLENE APPARATUS

Acetylene number of the SCIENTIFIC AMERICAN SUPPLEMENT, describing, with full illustrations, the most recent, simple or home made and commercial apparatus for generating acetylene on the large and small scale. The gas as made for and used by the microscopist and student; its use in the magic lantern. The new French table lamp making its own acetylene. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1057.** Price 10 cents prepaid by mail. For other numerous valuable articles on this subject we refer you to page 21 of our new 1897 Supplement Catalogue, sent free to any address. MUNN & CO., 361 Broadway, New York.



Blodgett
Comb, twist drill, thread pitch, centre and top drill gauge.
Price, $1.50 each.
Gauge and 510 page catalog sent postpaid for $1.40 or catalog alone for 25c.
MONTGOMERY & CO., TOOL MAKERS,
105 FULTON STREET, NEW YORK CITY.

A TIGHT GRIP.

The **SKINNER PATENT DRILL CHUCK** is simple, strong, and accurate. The jaws are of hardened tool steel. Stands severest tests. Is self-centering, self-tightening, most durable. Holds straight or taper shank drills.
☞ *Send for catalogue.*
SKINNER CHUCK CO., Church St., New Britain, Conn.

On Receipt of Ten Cents in Stamps (practically 25% of retail price) **we will send you one of our**
I-2 INCH AUGER BITS

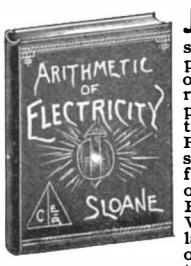
A fine cutting tool, perfect clearance, especially good in hard wood and for end boring. *Send for Cir. S. A., free.*
THE FORD BIT CO., HOLYOKE, MASS.

BEST Drying Machines
for Grain, Sand, Clays, Fertilizers, Phosphates, Ripe Coffee, Wet Feeds, Salt, Sugar, Chemicals, etc. 15 Years in operation. *Send for 6th illustrated catalogue.*
S. E. WORRELL, Hannibal, Mo.

Arithmetic of Electricity

By Prof. T. O'CONOR SLOANE.

138 Pages, Illustrated, Price $1.00



A PRACTICAL Treatise on Electrical Calculations of all kinds reduced to a series of rules, all of the simplest forms, and involving only ordinary arithmetic; each rule illustrated by one or more practical problems, with detailed solution of each one. Followed by an extensive series of Tables, including the following subjects: All Kinds of Units of Measurement of Electrical and Mechanical Work, Energy and Heat; Relations of Different Systems of All Kinds of Units; Relation of Different Wire Gauges, American and Foreign; Electrical Properties of Wire of Different Sizes; Specific Resistances; Thermo-chemical and Electro-chemical Equivalents; Useful Factors, etc., etc.

This book may be classed among the most useful works published on the science of electricity, covering, as it does, the mathematics of electricity in a manner that will attract the attention of those who are not familiar with algebraical formulæ.

We can also furnish Prof. Sloane's works on electricity as follows:

Arithmetic of Electricity, 138 pages.....$1.00
Electric Toy Making, 140 pages..... 1.00
How to Become a Successful Electrician, 189 pages..... 1.00
Standard Electrical Dictionary, 682 pages..... 3.00
Electricity Simplified, 158 pages..... 1.00

The above five volumes, comprising a **COMPLETE ELECTRICAL LIBRARY**, sold at the *special reduced* price of **$5.00** put up in a neat folding box. *You save* $2.00 *by ordering the set complete.*
Five volumes 1,300 pages, over 450 illustrations.

☞ Send for special circular containing full table of contents of the above books.

MUNN & CO., 361 Broadway, New York.

© 1898 SCIENTIFIC AMERICAN, INC.

STEAM ENGINEERING

TAUGHT BY MAIL

Learned by study at home in your spare time. Able instructors. Superior text-books free. Fees moderate.

$2 in ADVANCE and $2 a MONTH

Pays for a College Education at Home.

Established 1891. **35,000 students and graduates.** Courses in Electrical, Mechanical or Civil Engineering; Mathematics; Chemistry; Mining; Architectural or Mechanical Drawing; Surveying; Plumbing; Architecture; Metal Pattern Drafting; Prospecting; Book-Keeping; Shorthand; English Branches.

References in every city and town. **All who study guaranteed success.** We have helped thousands to better positions. **Circular free. State subject you wish to study.**

INTERNATIONAL CORRESPONDENCE SCHOOLS, Box 942, Scranton, Pa.

The Best Place to Study Engineering IS PITTSBURGH.

Write for a prospectus of the Engineering Department of the Western University of Pennsylvania, to W. J. HOLLAND, LL.D., Chancellor, Pittsburgh, Pa.

This beats Wind, Steam, or Horse Power. We offer the **WEBSTER 2½ actual horse power GAS ENGINE** for **$150,** less 10% discount for cash. Built on interchangeable plan. Built of best material. Made in lots of 100 therefore we can make the price. Boxed for shipment, weight 800 pounds. Made for Gas or Gasoline. Also Horizontal Engines, 4 to 30 horse power.

☞ *Write for Special Catalogue.*

WEBSTER MFG. CO., 1074 West 15th St., CHICAGO
Eastern Branch, 38-D Dey Street, New York City.

MIETZ & WEISS KEROSENE ENGINE

the most economical power known. Absolutely safe and reliable. Runs with common kerosene. Perfectly automatic. Patented 1897 U. S. and European countries.

128-132 Mott St., NewYork

Weber Gasoline Mine and Mill Pumps

ALL SIZES.

FOR ALL DUTIES.

Economy and Efficiency Guaranteed.

Address, stating capacity and conditions,

WEBER GAS AND GASOLINE ENGINE CO.
402 S. W. Boulevard, Kansas City, Mo.

"WOLVERINE" GAS & GASOLINE ENGINES

STATIONARY AND MARINE.

The "Wolverine" is the only reversible marine gas engine on the market. It is the lightest engine for its power. Requires no licensed engineer. Absolutely safe. Manufactured by

WOLVERINE MOTOR WORKS, 12 Huron St., Grand Rapids, Mich.

NO FIRE, SMOKE, OR HEAT. ABSOLUTELY SAFE

$200 and up. Send 5 stamps for Catalogue.
Truscott Boat Mfg. Co., Drawer 9, St. Joseph, Mich.

FRONTIER GAS ENGINES.

Vertical, 1 to 10 H. P. Tandem, 10 to 100 H. P. ☞ *Send for Catalogues.*

FRONTIER IRON WORKS
No. 6 Chene Street, Detroit, Mich.
THE YARYAN CO., East'n Agts., Times Bldg., N. Y. City

CONTROL OF FIRE.—VALUABLE PAPER on fire extinguishment. SCIENTIFIC AMERICAN SUPPLEMENT **1134.** Price 10 cents. For sale by Munn & Co. and all newsdealers.

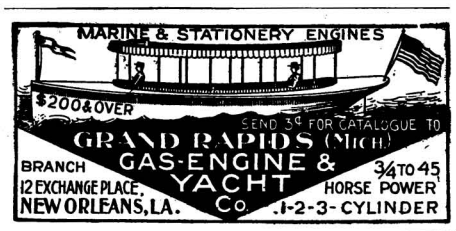
VAPOR LAUNCH COMPLETE FOR $150 AND UPWARDS

Row, Sail or Steam Boats.

☞ *Send five cents for catalogue.* **Racine Yacht and Boat Works, Racine Junction, Wis., Box A.**

This $300.00 Launch for $200.00, guaranteed or money refunded. Also builders of Row and Sail Boats.
Send stamps for catalogue. **Racine Boat Mfg. Co., Chicago**

ACETYLENE GAS AND CARBIDE OF Calcium.—All about the new illuminant, its qualities, chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Details of furnaces for making the carbide, gas generators, gasometers, burners, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035, 1038, 1057, 1064, 1071, 1072, 1082, 1083, 1084, 1085, 1086, 1104, 1124, 1132, 1149** and **1150.** Price 10 cents each, by mail, from this office, and all newsdealers.


MARINE & STATIONERY ENGINES
$200 & OVER
SEND 3¢ FOR CATALOGUE TO
GRAND RAPIDS (Mich)
BRANCH 12 EXCHANGE PLACE, NEW ORLEANS, LA.
GAS-ENGINE & YACHT Co.
¾ TO 45 HORSE POWER
1-2-3-CYLINDER

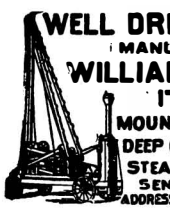
FOR FIRE PROTECTION which means cheap insurance, put in a

CALDWELL TANK AND TOWER.

Endorsed by the leading Insurance Companies.
W. E. CALDWELL CO., 217 E. Main Street, Louisville, Ky.

Hub, wheel, G. A. Skarin	605,208
Hydraulic motor regulating device, A. J. L. Loretz	605,169
Hydrocarbon burner, C. R. Kittle	605,200
Indicator. See Heat or cold indicator. Station indicator.	
Induction coil, A. L. Bogart	605,174
Inhaler, J. H. Kellogg	605,436
Inkstand, E. Davis	605,177
Instructing device, R. Springborn	605,144
Insulating handle connection, W. McAusland	605,448
Insulator, F. M. Locke	605,109
Insulator, R. D. Mershon	605,256
Jack. See Lifting jack.	
Joint. See Pipe joint. Rail joint. Stovepipe joint.	
Joint making tool, J. Birtwisle	605,195
Jug or vessel for containing liquids, W. A. S. Benson	605,071
Key opening can, E. Barrath	605,456, 605,457
Knife and scoop, combined, J. A. Sweeting	605,209
Label holder, J. R. Weller	605,213
Lamp, electric arc, W. Hochhausen	605,228
Lamp, incandescent gas, Von Heydebrand und der Lasa & Loch	605,250
Lamp safety lock, incandescent, Faller & Herbstritt	605,279
Lamp, self-adjustable bicycle, F. S. Snyder	605,354
Lasting machine, C. Eisenberg	605,091
Latch, N. J. Meigs	605,170
Latch and lock, combined, Smith & Putt	605,353
Lathe recessing tool, G. E. Miller	605,184
Leather staking machine, M. H. Connor	605,272
Lifting jack, P. Brown	605,072
Lifting jack, W. E. Tyler	605,210
Liquids, pneumatic elevating device for, A. Warter	605,212
Lock. See Combination lock. Lamp safety lock. Sash lock. Seal lock.	
Lock, G. L. E. Petorin	605,337
Lock, H. B. Richardson	605,342
Locomotive, log hauling, W. A. Fletcher	605,413
Loom slack alarm and stop motion, J. & J. Harriman	605,199
Marker for graves, lands, etc., J. A. Coffey	605,395
Match box, R. M. Dixon	605,276
Meats, marking, A. F. Nathan	605,120
Metals, tool and holder for use in cutting, boring and slotting, W. H. Hardy	605,422
Mill. See Windmill.	
Mould. See Glass mould.	
Moulding flasks, hand clamping device for, J. Scherer	605,347
Monkey wrench, ratchet, C. E. Frederickson	605,444
Mop wringing attachment for pails, F. Trimble	605,362
Motion, mechanism for converting rotary to reciprocating, J. W. Butterfield	605,218
Motor. See Powder motor.	
Motor, F. A. Brennan	605,382
Motor, J. F. W. Koetter	605,439
Mower, lawn, P. C. Burhans	605,074
Mower, lawn, W. W. Crockett	605,176
Musical instrument, mechanical, A. Richter	605,134
Neckties and collars to shirts, means for fastening, C. E. Sipp	605,262
Note reading device, vocal and instrumental, E. G. Wickersham	605,157
Nut, R. R. Parrish	605,450
Nut lock, C. H., Jr., & J. F. Charlton	605,078
Oiler, J. Lines	605,321
Organ, J. E. Davis	605,404
Overalls, C. G. Smith	605,236
Pad. See Step pad.	
Paper feeding machine, T. C. Dexter	605,088, 605,089
Paper feeding machine, J. F. McNutt	605,328
Paper registering machine, Dexter & Parker	605,275
Pencil sharpener, F. W. Warren	605,440
Photographic finder, H. B. Carlton	605,245
Photographic print washer, W. H. Leigh	605,229
Picker. See Fruit picker.	
Pin. See Clothes pin.	
Pipe. See Drainable pipe.	
Pipe joint and union, T. F. Hammer	605,098
Pipe wrench, A. E. Brockett	605,441
Pipette, A. W. Stokes	605,146
Pistol, ammonia and water, A. F. Humphrey	605,430
Planter, potato, J. A. Cooper	605,396
Plants, machine for reducing pithy, A. F. Madden	605,293
Plow attachment, J. E. Ball	605,172
Plow, sulky, Danielsen & Merrill	605,085
Plow, sulky, W. H. Perrin	605,298
Plucking machine, I. Dresdner	605,311
Polishing compounds to polishing or cutting tools, supplying, F. Holland	605,283
Post. See Fence post.	
Powder motor, T. M. Freeble	605,445
Press. See Baling press. Fruit press. Hay press. Printing press. Reducing press.	
Printing press, A. H. Smith	605,350
Printing press for cutting ribbons and counting same, F. Berkemeyer	605,173
Pulley, J. C. Knoblock	605,104
Pumping engine, pneumatic, E. A. Rix	605,187
Punching machine sheet feeding mechanism, W. Painter	605,334
Puzzle, O. J. Haarlaender	605,096
Puzzle, E. A. Shields	605,191
Rack. See Ticket rack.	
Radiators, automatic air valve for steam, L. G. Kirk	605,315
Rail bond, G. Moffat	605,115
Rail joint, G. A. Weber	605,265
Rail mounting, third, S. H. Short	605,260
Railway fog signaling apparatus, H. Tomlins	605,361
Railway rail end support, J. B. Squire	605,145
Railway rail tie, E. R. Stiles	605,356
Railway signaling and switching apparatus, J. D. Taylor	605,359
Railway system, electric, W. Lawrence	605,317
Railway tie, M. Riley	605,233
Railway tie, metallic, J. M. Clark	605,270
Railways, third rail for electric, S. H. Short	605,261
Razor, safety, E. E. Deputy	605,274
Recorder. See Fare recorder. Time recorder.	
Reducing press, L. J. Kingsley	605,167
Regulator. See Gas regulator.	
Retort and making same, H. S. Blackmore	605,379
Roller. See Dirt roller.	
Rotary engine, M. E. Gilbert	605,460
Rubber shoe attachment, C. E. Posh	605,232
Salt making apparatus, T. Craney	605,082
Sand board, L. M. Elliott	605,198
Sash balance, Barber & Ashby	605,215
Sash lock and lift, combination, I. W. Brown	605,196
Sashes, means for hanging and guiding, E. Beck	605,069
Saw, crosscut, R. Wrublik	605,368
Sawing machine, L. A. Deuther	605,406
Seal lock, P. C. Dockstader	605,277
Seal lock, W. K. Edgar	605,278
Seat. See Couch seat.	
Seeding machine, W. W. Schultz	605,348
Separator. See Grain separator.	
Sewing machine, Muther & Holland	605,325
Sewing machine folding guide, L. Muther	605,324
Sewing machine presser foot and throat plate, C. McNeil	605,449
Sharpener, knife, scissors or skate, M. L. Hawks	605,289
Shelving, stack, etc., library, D. E. Hunter	605,291
Sifter, portable coal, L. Buchtel	605,175
Signaling device, F. B. Taylor et al	605,358
Skate, hockey game, E. H. Barney	605,285
Smelting plant, continuous, Reese & Armstrong, 605,451,	605,464
Smoke bell, T. C. O. Sherk	605,234
Smoke condenser, J. C. Green	605,280
Soda, apparatus for making caustic, W. F. Jobbins	605,102
Spark arrester, J. W. Troutt	605,363
Spark extinguisher, M. Pschorr	605,131
Spinning machine, wool, W. W. New	605,205
Spool stand, T. Mason	605,254
Sprocket wheel, L. & E. W. Cooper	605,443
Stamp mill feeder, G. Wood	605,266
Stand. See Display stand.	
Station indicator, O. Ledowsky	605,318
Stay and fastener, P. A. Dailey	605,402
Steam boiler and furnace therefor, W. Hopkins	605,427
Step pad, H. C. Swan	605,357
Stopper. See Flue stopper.	
Stopper, W. Nutt	605,125
Stove, cooking, A. W. Walker	605,303
Stove or other grate, A. Alitto	605,242
Stovepipe joint, F. Tharp	605,265
Strap. See Car strap.	
Strap fastener, G. S. Sammis	605,300
Street sweeper, A. Brown	605,385
Street sweeper, W. Franz	605,415
Sulfids, making, H. S. Blackmore	605,458
Sulky and device for attaching horses thereto, single wheel, T. S. Heath	605,099
Switch. See Automatic lever switch. Electric switch. Trolley switch.	
Syringe, fountain, F. C. Ferguson	605,178
Table attachment for chairs or beds, F. T. Heatly	605,100
Target, W. F. Hochspeier	605,314
Telephone holder, J. T. Moore	605,294
Telephone system, E. W. Ham	605,097
Telephone system, Reid & McDonnell	605,341
Telescopic clamp, G. W. Kortright	605,447
Testing trap, Buist & Breakell	605,387
Thread tension device, I. Heer	605,101
Thrashing machine foldable straw carrier, A. R. McMullen	605,327

(Continued on page 399)

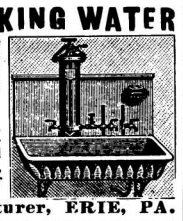


WELL DRILLING MACHINERY.
MANUFACTURED BY
WILLIAMS BROTHERS,
ITHACA, N.Y.
MOUNTED OR ON SILLS, FOR DEEP OR SHALLOW WELLS, WITH STEAM OR HORSE POWER
SEND FOR CATALOGUE
ADDRESS WILLIAMS BROS. ITHACA, N.Y.

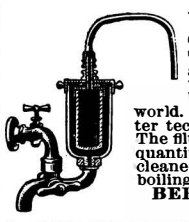
ARTESIAN WELLS

Any depth from 10 to 2,000 feet. Wells for the Improved Air Lift Pump a specialty. Old dug wells made deeper. Test Boring for Water. Soundings made for Foundations. ☞ *Send for references and particulars.*
I. H. FORD & CO., 104 Fulton St., New York

PURIFY YOUR DRINKING WATER



Pure water is as necessary as pure food or pure air. Impure water is the direct cause of many deadly diseases. The foulest water is made pure by the use of **Watson's Natural Stone Filter.** It thoroughly removes all dirt, germs, vegetable and animal matter, destroys the gases and foul odor, and leaves the water pure, sparkling and clear. ☞ *Send for Catalogue and Price List.*
N. A. WATSON, Manufacturer, ERIE, PA.

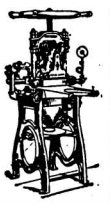


THE BERKEFELD FILTER

The Standard of the World. The only filter removing typhoid and cholera bacilli from the water. Tested and recommended by Bacteriologists all over the world. The greatest invention in the filter technic during the last ten years. The filter gives water in small and large quantities according to the sizes. Easily cleaned, filter cylinders sterilized by boiling in water. Send for circulars to
BERKEFELD FILTER CO., 4 Cedar Street, New York.

DORMAN'S VULCANIZERS

are used all over the world.



Exclusive Manufacturers of Steam Machines for Rubber Stamps. We also make Dry Heat Vulcanizers. Complete outfits from $10 to $1,000. All Stamp and Stencil Tools and Supplies. Brass and Steel Dies for all purposes. Seals, Engraving and Die Sinking of all kinds. Established 1860. Printing Presses, with complete outfits, from $1 to $100. ☞ *Send for Catalogues.*
THE J. F. W. DORMAN CO.
121 E. Fayette St., Baltimore, Md., U. S. A.

A. W. FABER

Manufactory Established 1761.

LEAD PENCILS, COLORED PENCILS, SLATE PENCILS, WRITING SLATES, STEEL PENS, GOLD PENS, INKS, PENCIL CASES IN SILVER AND IN GOLD, STATIONERS' RUBBER GOODS, RULERS, COLORS AND ARTISTS' MATERIALS.

78 Reade Street, • • • New York, N. Y.
Manufactory Established 1761.

FANS FANS FANS
KEEP COOL
BACKUS WATER MOTOR CO. NEWARK N.J. U.S.A.

SIMPLEX TIME RECORDER

So named because it is simple in construction, simple in operation and simple of record. Saves maximum of time with minimum of labor. Registers by the push of a button—nothing more. One hundred men can register in one minute on one recorder. Adapted to large or small concerns. No keys, checks, cards, tape or ink ribbon. For simplicity, compactness, durability and quick registration absolutely without rivals. Full description for the asking. Ask Now. Address Heywood Bros. & Wakefield Company, 195 Canal St., New York City. N. B—For prices, state number of your employés.

N. Y. CAMERA EXCHANGE.

50% Saved on all makes of Cameras

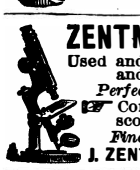
Headquarters for Buying, Selling and Exchanging Cameras or Lenses. Large assortment always on hand.
Developing, Printing, etc.
Photo supplies of every description at *lowest prices.*
☞ *Send 2c. stamp for bargain list.* Address
N. Y. CAMERA EXCHANGE, 43 Fulton St., NEW YORK

TYPEWRITERS HALF PRICE

We will sell you any typewriter made for one half regular price, many for one quarter. Every machine guaranteed in perfect order. TYPEWRITERS SOLD, RENTED, EXCHANGED. Sent anywhere with privilege of examination. Send for Illustrated catalogue.
National Typewriter Exchange, 214 La Salle St., Chicago.

"GEM" CLOVER CUTTER

SPECIALLY FOR POULTRYMEN.
BEST IN THE WORLD.
Cuts Green or Dry, fine, even and easy.
WILSON BROS., EASTON, PA.



ZENTMAYER'S MICROSCOPES.

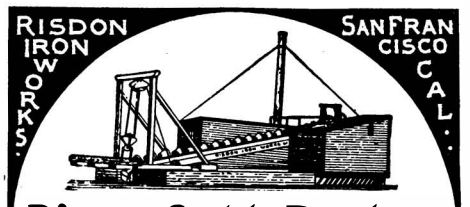
Used and indorsed by the leading Professors and Colleges throughout the world.
Perfection in the Art of Microscope Making.
☞ Complete illustrated catalogue of Microscopes and Optical Apparatus sent Free.
Fine Instrument Making and Repairing.
J. ZENTMAYER, 211 So. 11th St., Phila., Pa.

THIS

Adjustable DRAWING Table

Hardwood Top 20"x28"

delivered in United States for **$8.00** each. Is easily adjusted, firm and durable. *Send for Catalogue to*
ADJUSTABLE DRAWING TABLE CO.
Office, Powers Opera House Block, Grand Rapids, Mich., U. S. A.



River Gold Dredger

THE MOST PERFECT YET INVENTED.

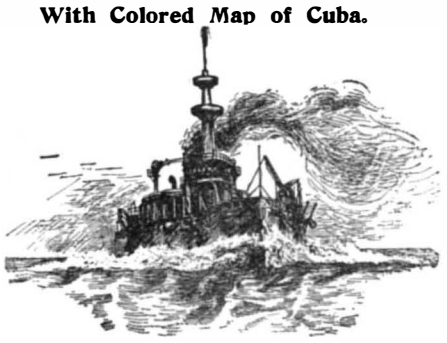
Money Made Quick and Fast. **Handles all material at a cost of but 3 to 5 cents cubic yard.** Adapted to all situations. Contract to erect and start in successful operation.

RISDON IRON WORKS,
200 Beale St., San Francisco, Cal.
BUILDERS OF
Mining and Marine Machinery, Irrigation and Water Works Plants, Boilers and Engines.

☞ *Send for Pamphlet*

THE Scientific American SPECIAL NAVY SUPPLEMENT.

With Colored Map of Cuba.



THE BATTLESHIP "OREGON."

The great desire during the present crisis for accurate information concerning the United States Navy has led to the preparation of a short treatise on the Navy, which has just been published under the above title. Every effort has been made by the publishers to treat the subject in such a manner that it may be readily understood by the reader unversed in naval affairs, and at the same time render the publication a permanent book of reference.

This issue consists of forty pages.

The number opens with a historical sketch of the birth and growth of the new Navy from 1883 to 1898, in which the programme of shipbuilding authorized in each year is given, together with the classes of ships which it called for.

This is followed by an article which explains the different types of vessels into which a modern navy is divided, and shows, by the assistance of diagrams, the manner in which the various types of vessels are classified. This article will greatly assist the reader in understanding the detailed illustrations and descriptions of each ship which make up the bulk of the issue.

The ships are grouped according to their type, as classified below. A comparison is drawn between different vessels of the same type, and the improvement of each ship on its predecessor is pointed out.

BATTLESHIPS.

"Indiana," 13 cuts: "Massachusetts," 2 cuts; "Oregon," 2 cuts; "Iowa," 3 cuts; "Texas," 2 cuts; "Kentucky," 2 cuts; "Alabama," 5 cuts.

CRUISERS.

"New York," 3 cuts; "Brooklyn," 1 cut; "Minneapolis," 1 cut; "Columbia," 2 cuts; "Chicago," 1 cut: "Olympia," 2 cuts; "Cincinnati," 1 cut; "San Francisco," 5 cuts; "Detroit," 1 cut; "Charleston, 1 cut; "Baltimore," 1 cut; "New Orleans," 2 cuts.

MONITORS.

"Amphitrite," 4 cuts; "Terror," 5 cuts; "Monterey," 3 cuts; "Miantonomoh," 4 cuts.

GUNBOATS and TORPEDO BOATS.

"Helena," 1 cut; "Annapolis," 1 cut; "Marietta," 1 cut; "Ericsson," 2 cuts; "Porter," 2 cuts; "Maine's" torpedo boat, 1 cut; "Bailey," 3 cuts.

SPECIAL CLASS.

Ram "Katahdin," 4 cuts; submarine boat "Holland," 2 cuts.

Under the cut of each ship is a full table of her dimensions, armor, guns, speed, etc., and this is supplemented by tables at the end of the work, giving complete tables of the whole fleet.

The illustrations number about 90, and include handsome half-tone views and wood-cuts of all of the vessels above mentioned. Other pictures show in great detail the guns, gun-turrets, torpedoes, steering apparatus, conning towers, and many interior and sectional views of other parts of these warships. The whole forms a most complete and fully illustrated periodical.

In addition to the above is included a reliable map in colors, showing the island of Cuba and the West Indies.

This issue is inclosed in a handsome colored cover for preservation.

Price, by mail, 25 cents.

To Foreign Countries, 7 cents extra for postage.

MUNN & CO., Publishers,
361 Broadway, New York City.

© 1898 SCIENTIFIC AMERICAN, INC.